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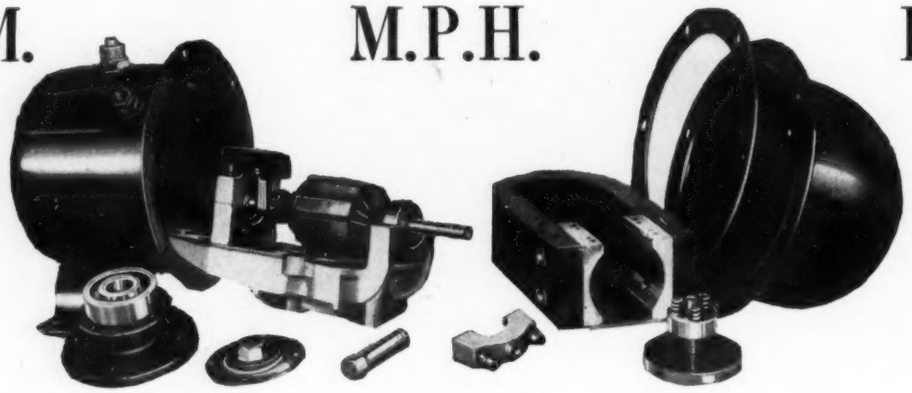

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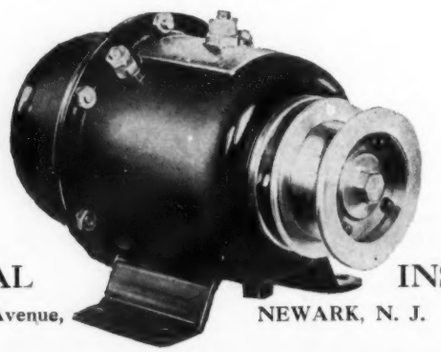

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Electrical World

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Public Utility Industry Loses Two Prominent Executives

TWO well-known public utility executives died last week—Randal Morgan, chairman of the executive and finance committee of the United Gas Improvement Company of Philadelphia, and C. G. M. Thomas, vice-president of the Consolidated Gas Company and chairman of the board of directors of the New York & Queens Electric Light & Power Company. Although both were primarily associated with the gas industry, they wielded great power in the electric light and power industry and knew more about the electric business in general than most electric men know about the gas business.

Mr. Thomas associated himself intimately with the civic and trade organizations of the Borough of Queens and established such an excellent record for himself and his company that he was made treasurer of the Consolidated Gas Company and afterward a vice-president. Mr. Morgan was a corporation lawyer by profession and entered the public utility business as counsel for the United Gas Improvement Company before the electric light and power business was established. With the advent of electric central-station companies the U.G.I. became interested to a considerable extent, and Mr. Morgan, whose work dealt chiefly with the corporation's finances, became a power in the electric light and power business as well. In his later years, however, he assumed an ultra-conservative attitude toward the electric public utility business, with the result that the United Gas Improvement Company was no longer so aggressive a factor in the electrical industry as it was twenty years ago. Its properties have, notwithstanding, increased in value and strength, and while the greater part of the credit for this is due to S. T. Bodine and his able corps of assistants, Mr. Morgan's contribution was weighty and significant.

Encouraging Outlook for Development of Southern Resources

THE industrial development conference held under the auspices of the Southern Division of the American Mining Congress in Memphis last week has perhaps done more than any other single agency to bring out all the latent possibilities of the states from Virginia to Texas. The separate state reports, each giving in detail the various mineral deposits within the borders of the commonwealth, the extent to which they have been developed and the possibilities for the future, form for the first time a composite picture of just what is available in this section of the country. These state reports and the assurance of the publication of Dr. Henry Mace Payne's report covering a two-year intensive study of the South's metallic and non-metallic resources should be of valuable aid in interesting capital in the industrial and commercial development of the resources cataloged.

It is very interesting to note the part played by electric power in all discussions at the conference. That no development could take place without power was emphasized by several speakers, and no report was made that did not include a comprehensive statement of power possibilities, whether based on hydro-electricity, steam or natural gas. Only through the instrumentality of electric power that is cheap, abundant and reliable can the natural wealth of the South be utilized in full. Light and power companies in all regions of the Southern States are keeping pace with the times, and the mining industry can be assured of the closest co-operation from them in all development work.

Interconnection Versus the Isolated Plant

OIL CITY, with 25,000 people, and Franklin, with 10,000, are not the largest cities in western Pennsylvania, but, situated in the center of the oil region and containing many industrial establishments, they have attained an importance that made of more than local concern the complete suspension of electric service in those places when floods followed an unusually stubborn ice gorge in the Allegheny River. To the cities themselves it was a disaster that thoroughly warranted the vigorous efforts put forth to combat it. Had the connection between the lines of the local company and the trunk system of the Penn Public Service Company which was rushed to completion in record time been made sooner, the cessation of service would not have occurred. Had it been of a permanent type, it is little likely that the renewal of the jam reported this week could have hurled a tower from its base. The moral is as obvious as any of Æsop's, and it is earnestly to be hoped that the slamming of the stable door—far from a futile procedure in this instance, for it brought back the horse, or, at any rate, the horsepower, which had escaped—will be heard by the managers of other isolated plants within reach of large transmission lines. If the lesson is heeded, flood, fire, lightning and explosions, regarded as possible sources of catastrophe, will dwindle and lose much of their terror for the managers of local operating companies.

Men or Machines?

MANY recent remarks have been heard to the effect that man has invented machines and applied pure science to build a world wherein man serves mechanisms rather than a world where the use of machines is subservient to the desires of man. Newton D. Baker recently observed that one of the great faults of civilization was the prevalence of inventors. Great waste results from discarding old things for the use of new things which are only slight improvements. He thought the world should take time to consolidate the wonderful things already supplied to it by invention and cease to struggle so avidly for something new but not much

better. Literary men, and even physicians, are talking and writing to the effect that the present industrial era has keyed up human efforts instead of providing the leisure and freedom that might have been expected from the many victories of applied science. Man, it is claimed, is becoming overwrought, nervous and incapable of enjoying the finer things of the world.

These expressions of opinion provide food for thought to engineers because the engineers have been largely responsible for the industrial era and have therefore a responsibility and an obligation to the race for the results they have obtained. But most engineers will deny these propositions and contend that they are brought forth by lack of knowledge and perspective. At no period of man's life has there been more individual wealth or individual freedom. The fruits of applied science have brought about a human equality never before known in history. They have made the world a unit in knowledge and in ideas for proper development. They have established a standard of public and private living and behavior better than ever before existed. No one today would exchange American conditions for those of China. No one would go back to the feudal system of the Middle Ages or to the Roman age, where luxury existed for the few and privation for the many.

Modern industrial civilization has grown rapidly and all links have not yet been welded, but it is based on sound principles and good social standards. There is much yet to be done, and the present is but an epoch-making interval in the building of a civilization far superior to any heretofore conceived by man.

Transmission Reliability

RELIABILITY of service from a transmission line is now largely a matter of dollars and cents spent on the line structure. Physical hazards from breaking wires, windstorms, sleet and ice can be measured and cared for by tower and line design. Definite data on lightning and surges are now available, and these hazards can be avoided by adequately insulating the line.

Insulation to withstand lightning and surges centers about the height of the line above ground, clearances, the use of the ground wire and the use of a sufficient number of insulating units. An economic answer to the problem of line insulation must be based on a careful analysis of all physical and electrical elements in the line. Ground wires, if used, must be mechanically safe and must have reliable grounds if they are to prove efficacious in lowering gradients. Otherwise, a saving in insulators because ground wires are used proves to be false economy. The important point, however, is that engineers can now build lines to give reliable service, because all data that affect line performance are known and the engineers can make economic analyses based on ascertained facts.

However, the total cost of building a line for continuous service is very high and may not be warranted by the load carried or the service rendered. Often 90 per cent service is a better economic solution to a transmission problem than 100 per cent service under the conditions that exist. Not only line economics but load and service economics must be considered. Then a decision can be made based upon complete knowledge. In every case where such a decision indicates that a 100 per cent service installation is not justified engineers can build a line adapted for improvement to give 100 per cent service at least cost. This will pave the way to the ultimate service to be obtained from each transmission line in after years.

Traffic Signals as a Load

HOW many light and power men have ever thought of traffic signals as a desirable load? Still, the figures given elsewhere in this issue by J. T. Miller, commissioner of gas and electricity of Chicago, would indicate them to be so. They have the merits of constituting a long-hour usage, having high consumption per unit of maximum demand and requiring little expenditure for electric service.

Reduced to terms which can be applied to a community of any size, the figures given by Mr. Miller indicate eighteen to twenty-four hours' use a day, an annual consumption per intersection of four units of 3,400 kw.-hr. to 4,500 kw.-hr. for eighteen and twenty-four hours' use respectively, and a base load of 400 watts with a maximum demand of 464 watts to 800 watts per intersection, depending on number and timing. Figured on the basis of a single unit, the consumption per year in the eighteen-hour district is 857 kw.-hr. and that in the twenty-four-hour district 1,080 kw.-hr.

Multiplying these unit figures by the number of intersections which could be equipped in every town a utility serves would give some interesting values. Elusive as it sounds, 667,000 intersections equipped with four electric traffic signals of the Chicago type would have a consumption equivalent to the total output of the Commonwealth Edison Company in 1924 and would demand only about 43 per cent of the peak load then recorded.

Can cities afford them? Well, even on the elaborate metropolitan basis upon which Mr. Miller installed them they cost only $625 apiece installed, including everything. Allowing as much as 25 per cent for interest, depreciation, insurance, inspection and maintenance, the yearly cost per intersection of four units would be only $625 plus the cost of 4,320 kw.-hr. (twenty-four-hour basis). This is much less than the cost of a traffic policeman, who could be utilized for other purposes, to say nothing of the value of co-ordinated traffic control.

In any event light and power companies will usually be called upon to serve traffic signals as they are installed, and knowledge of anything which will reduce maintenance expense will be valuable if the utilities have to maintain them.

Arc Welding in Atomic Hydrogen

THE March issue of the *General Electric Review* contains three articles of more than usual interest on recent progress in the art of electric arc welding. The innovation consists in blowing a stream of hydrogen gas, mixture of hydrogen and nitrogen, hydrogen and carbon monoxide, or some other suitable mixture, across the electric arc and bathing the weld in these hot dissociated gases. It is claimed that with such a procedure a much more ductile, strong and pure weld is produced and that the penetration is greater because of higher temperature. The reason for a better weld primarily lies in the exclusion of oxygen or in its combination with the gases blown in, thus protecting the material of the weld. Any oxides present are also reduced by

the above-mentioned gases. It is expected that this improvement will make it possible to extend the field of electric welding.

An interesting feature of this development is its rather remote origin in pure science—in a study of heat conduction in a vacuum tube. Dr. Irving Langmuir, to whom this development is primarily due, noticed some years ago an abnormal heat conduction from a heated tungsten wire through an atmosphere of hydrogen. This led to a discovery of atomic hydrogen, H, dissociated by intense heat from molecular hydrogen, H_2. It then occurred to him to blow ordinary molecular hydrogen across an electric arc, partly dissociating the gas into atomic hydrogen, at the expense of the energy of the arc. This hydrogen is then recombined into the molecular form at some distance from the arc, giving rise to temperatures as high as 4,000 degrees absolute.

Make Residence Business Good Business

WHEN a home is connected to utility electric service its business possibilities are made available. Each house should be viewed in the light of its possibilities for service and not as a business handicap. For it is the duty of a utility to give the best and most complete electric service to each home.

An enormous investment lies back of residence service, yet the ordinary home has a load factor of only 10 per cent and a consumption of only one kilowatt-hour a day. This usage and this load factor have served to create the opinion that residence business is not profitable, and it has therefore received little attention. But these very facts should make residence business receive the greatest possible attention. A large number of additional home electric services are known, and tried means are at hand to intensify the use of existing services.

It is only necessary to educate the households of America and to put to work known ideas in utility business. It is not a matter of dollars and cents in the form of costs and revenues. It is a matter of educating people to the value of service. No progressive home dweller today would use other than electric light if price differentials were ten times in favor of some other illumination source. People know the value of the service given by electric light through education and experience. They can be educated to use many times the present amount of light from the same value-of-service standpoint.

The flatiron, the toaster, the vacuum cleaner and the washing machine are other valued services known to residence consumers. They were established in the homes with very little effort. But there are many other devices yet unused in the homes. The range, the socket radio, the refrigerator, the radiant heater, the water heater and the electrically operated oil-burning furnace are available already to increase residence consumption and load factor to such a degree that not only will the residence business support rebuilt distribution systems but it will be the most profitable class of business served.

Future possibilities are in large measure readily visualized. It is not ridiculous to conceive of many homes with properly insulated walls and windows, where electric heat, refrigeration and ventilation will unite to give a uniform temperature during the year and where illumination effects heretofore reserved for demonstrations will be part of the daily household routine. Foresight and courage are needed in a consideration of residence business. In its visioned possibilities becoming actual realizations lies the hope for continued rate reductions, greater public service and increased prosperity for the light and power industry.

A Welcome Transportation Unit

THE gas-electric and oil-electric locomotive has established itself as an economical transportation unit for railroad switching and branch-line services. Its use should lead to an easier transition from steam to all-electric locomotives by railroad officials and operatives. Thus it should be a decided asset for electrification.

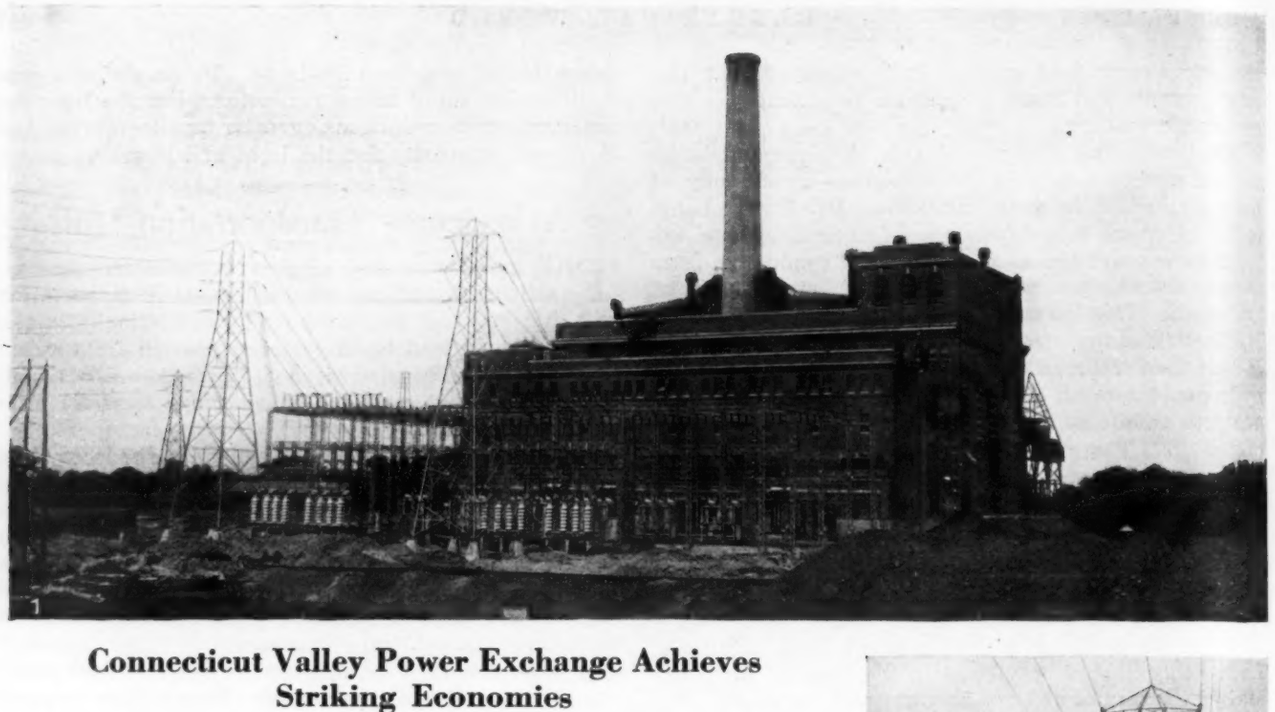
In no sense is this new and popular type of locomotive a competitor of electrification. It serves on light-traffic branch lines and for switching and is not proposed for either terminal or trunk-line service where the traffic density is high. Experience on many roads proves this equipment to be superior to steam locomotives in economy and in service for the type of transportation service in which it is used, and it has served to satisfy railroad men that electrical equipment is reliable and easily maintained. Branch line after branch line reports splendid service from the new units, and the operating forces are "sold" on the electromotive equipments.

The use of the new units should be approved by the electrical fraternity, for this will make for decisions regarding electrification which will be based on economic factors and will remove from the discussion considerations concerning the training of operatives to understand electrical equipment, questions as to the reliability of electrical equipment and queries as to the performance of electrically driven locomotives.

The Kitchen-Unit Campaign

OF ALL the lighting campaigns in the residential field the kitchen-unit campaign has been the most generally pushed. For this reason its progress and possibilities are of particular interest. A year ago it was under way in communities representing at least three million residential customers, or one-fourth the total in this country. Up to the beginning of 1925 these communities reported a sale of 333,000 kitchen units, or about one in each ten wired homes. A total increase in annual revenue due to these units was reported to be more than a million dollars, or an average increase in annual revenue of nearly $4 per kitchen unit. If a modern kitchen unit were installed in each wired home in this country, the total increase in annual revenue from these units would approximate at least fifty million dollars. Considering the low cost of the unit, the ease of installation and its value in building a "lighting consciousness" in the home, quite aside from the revenue increase, the kitchen unit is an attractive object of campaign.

Notwithstanding this, a recent survey indicates that during 1925 this campaign did not gain in momentum. In fact, it appears to have received less attention in general than it did in the two preceding years. Saturation point and increased sales resistance cannot be legitimate excuses for this slowing up in the kitchen-unit activity. With only one kitchen in ten equipped with a modern unit and with 63 per cent of the ceiling fixtures in the kitchen of an absolutely obsolete type, the kitchen-unit campaign should be gaining rather than slowing up.



Connecticut Valley Power Exchange Achieves Striking Economies

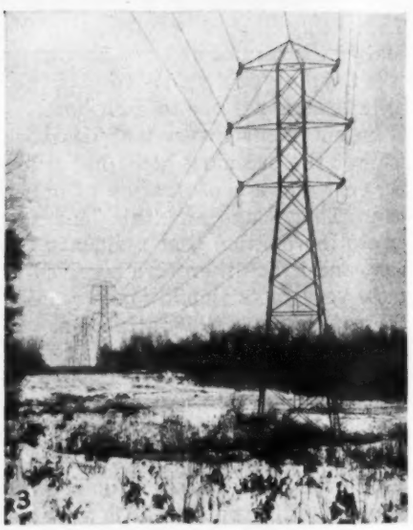
COAL in the amount of 50,000 tons was saved in the first ten months' operation of the 66-kv. line interconnecting the systems of the Turners Falls (Mass.) Power & Electric Company, United Electric Light Company, Springfield, and Hartford Electric Light Company through the co-ordinated operation of the hydro-electric and steam plants illustrated. This power exchange also improved the quality of service and helped prevent interruptions in central New England, besides enabling extensive investments in additional generating plant capacity to be postponed. No better example of territorial "superpower" application could be cited.

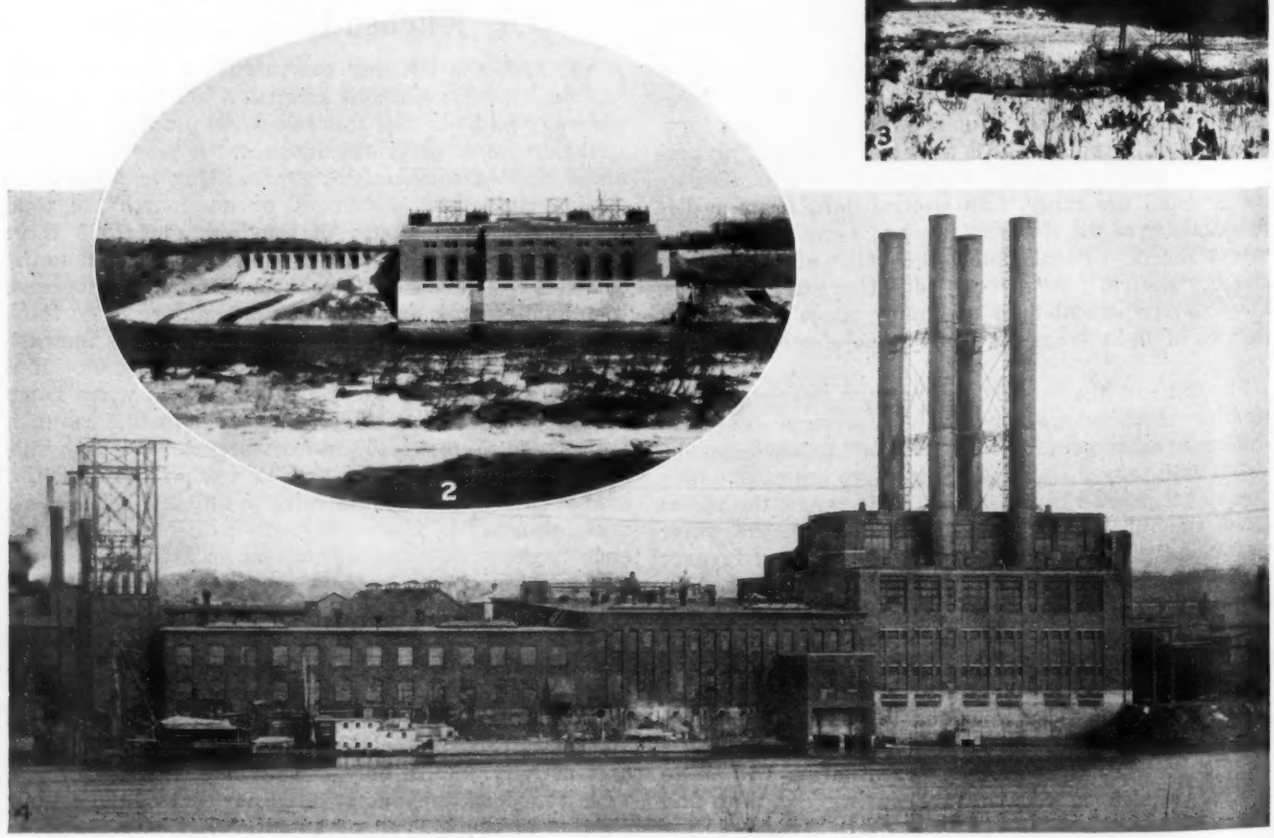
1. South Meadow Station, Hartford Electric Light Company.

2. Cabot Station, Turners Falls Power & Electric Company.

3. The 66/110-kv. line from Agawam, Mass., to Hartford, Conn.

4. State Street Station, United Electric Light Company, Springfield, Mass.





Residence Business and Range Load

Use Ranges as Entering Wedge to Larger Residence Consumption—Data on Investments and Returns—Demand and Diversity Known—Commercial Policy and Rates

THE light and power industry has been investing money in order to build a nation-wide structure for giving electrical service. Power houses, transmission lines and distribution systems have been built at great cost, and there remain no large cities or large geographical areas without electric service facilities. This physical structure has meant the investment of more than six billion dollars and requires correspondingly large earnings if the industry is to progress.

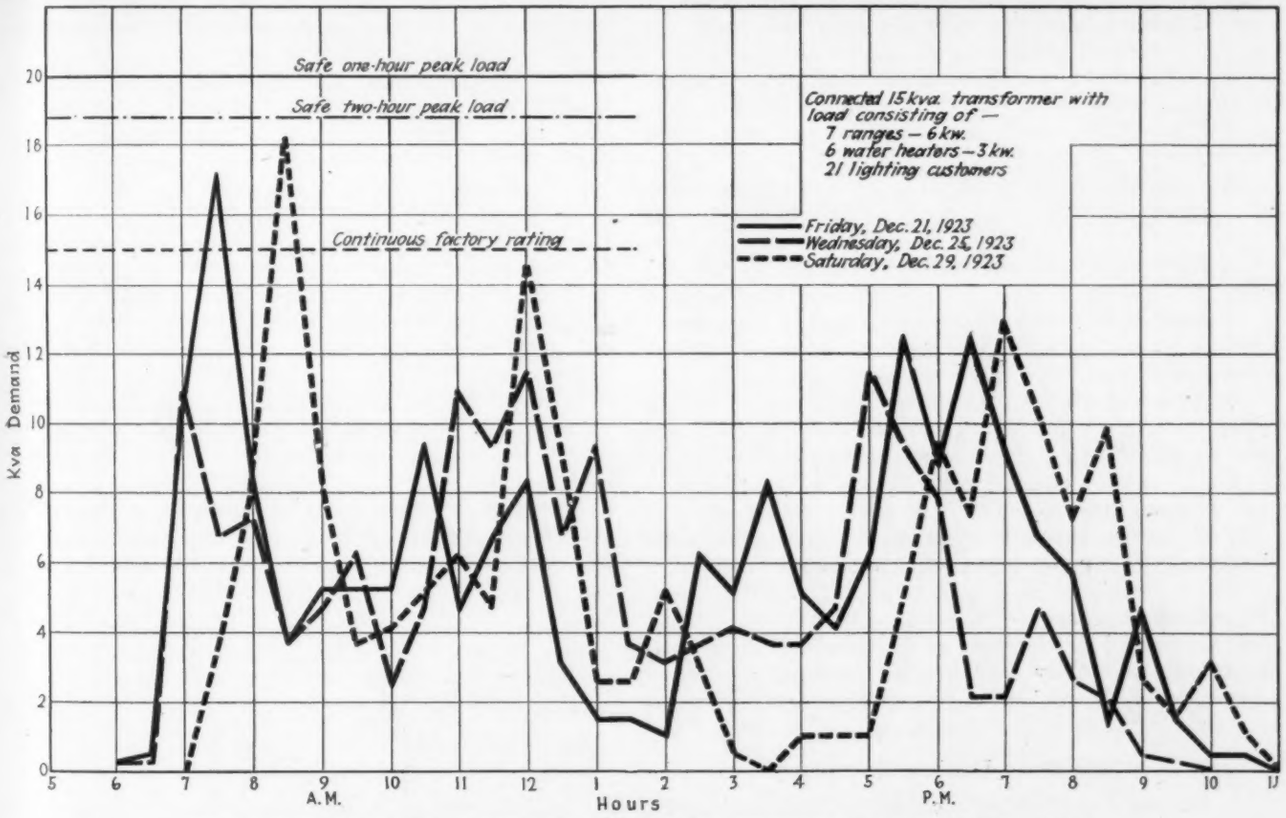


FIG. 1—WINTER LOAD CURVE SHOWING A 15-KVA. TRANSFORMER SUPPLYING SEVEN RANGES, SIX WATER HEATERS AND 21 LIGHTING CUSTOMERS

During this period of physical structure building commercial aspects of the business have received little executive attention. The goal of commercial departments was reached when homes and factories were connected to utility lines and there was little endeavor to increase the consumption per customer. Natural expansion and normal demands for electricity supported the necessary investments. But today there is need for serious thought on commercial activities. A great investment in utility property is carried for residences which use little energy, power loads readily obtainable are difficult to find; in general, the rate of expansion of connected residential and power load follows the normal national growth of homes and factories and the unserved pools of homes and industries have been drained.

The commercial problem today is to secure greater energy use per customer. This requires that he first be provided with the means for using more energy and, second, that the use of energy be encouraged by the proper form of rate. There is a natural increase in electrical business which comes about through the normal growth of a community and a greater appreciation of the advantages of electric service, but there remains ample opportunity for an artificial growth stimulated by intelligent commercial effort devoted to exploiting new uses for energy and greater use of existing services. This stimulated growth makes for improved load factor, greater density of load and, ultimately, reduced costs and rates.

COMMERCIAL POLICY

The consensus of opinion in the utility industry is that residential load carries the largest investment in proportion to revenue and has been exploited commercially to the least degree. The average consumption of the residential customer is only 1 kw.-hr. per day and very conservative estimates indicate an opportunity to increase this consumption ten times with a load factor increase of from four to five times. But commercial effort must be devoted to this business to secure such results.

It is believed that every light and power company should actively engage in building residential business and that most of them should embark upon an active merchandising program. The best opinion and widest experience indicate that certain principles of policy are sound for each utility to adopt with respect to commercial activities:

1. Each utility should take the lead in each community in commercial activities and strive to get all electrical groups actively and co-operatively at work.
2. Each utility should establish a merchandising department with adequate finances, personnel and facilities for doing business on a self-sustaining departmental basis.
3. Each utility should establish a servicing department to serve all customers on call at a reasonable cost to the customers.
4. Each utility should recognize that pioneering work on new appliances involves credit, costs and skill beyond those involved in the sale of established merchandise and therefore it should take the lead and carry the major burden in pioneering commercial activities.
5. Each utility should maintain list prices and sell first-class merchandise.
6. Each utility should recognize and encourage other distributors of merchandise, because they add to the volume of merchandise sold to customers and thus add to the system load and because this policy builds good will.
7. Each utility should establish a rate structure which will encourage the use of all possible electrical devices.
8. Each utility should recognize that a certain degree of saturation should be assumed before cost allocations are made to any energy-using device.
9. Each utility-merchandising department should adopt and follow the best and most complete sales and service plan that can be developed.
10. An ethical obligation as well as a franchise obligation rests upon each utility to give a maximum residential service through building increased residential business. This policy proves also to be good business.

These principles have been tried out and have been proved sound. They are based on good public relations, the most rapid development of business and good business practice. They lead in the direction of electric service with the highest customer consumption, lowest customer cost and highest customer load factor.

Approach to Utility Executives

A general executive opinion exists that residential business is not profitable, and it has been with great reluctance that large investments have been made recently to rebuild distribution systems to carry larger residential loads. This opinion is largely an opinion and is not based on detailed cost allocations by business classes. Yet, granted the opinion is correct, residences must be served and it can be proved beyond question that residence business can be built to a load factor and consumption that will make it the most profitable business of any utility.

Engineers and accountants have damned the residence business because of their lack of commercial knowledge, and commercial men have lacked sufficient engineering and accounting knowledge to prove their case. As a result the executive has taken the figures of engineers and accountants rather than the opinions of commercial men.

Cost allocations are dangerous and difficult to apply to residence loads. Time and again they have been made in such a way as to damn a class of business or a residential device when the facts would prove the business or the device was worth while. For example, it is unfair to apply cost allocations made on the basis of a saturated or developed business to an unsaturated or pioneering business. Yet cost allocations have been made whereby an electric range has been charged with its rated capacity in the power house, transmission system and distribution system and in addition has been charged with the whole cost of rebuilding the distribution system to carry heavy current devices.

Any cost or load analysis should be made from a consideration of the whole system and a reasonable degree of use saturation. No one class of business should be considered as self-contained. The mutual effect of classes on load factor, diversity factor, peak load, investment, revenues and consumption must be weighed. And seasonal climatic changes, the effect of industrial depressions, reactions on public relations and daily, monthly and yearly time elements must be considered as influential elements in a decision.

The object of any utility should be to utilize its investment a maximum number of hours, to expand and diversify its service as greatly as possible and to realize earnings which are reasonable.

Building Residence Business

With the present use of energy in residences so low on most properties, all residence load-building business must be considered in the pioneering class. Lighting, appliances, refrigerators, ranges, electric washers, electric ironers and other residence services are unexploited to any large extent.

The distribution system on most properties is inadequate to carry possible residence loads and must be rebuilt before any great increase in load can be had. Under these conditions it is good business to add to each residence heavy current-consuming devices as quickly as possible. For example, any distribution system sufficiently heavy to carry the range load can carry the other residence devices without any change.

TABLE I—TOTAL INVESTMENT FOR RANGES

Company	Number of Ranges	Average Cost to System	Wiring Cost to Consumer
A	1,000	$77.80	$35.00
B	950	74.20	40.00
C	25	95.00	45.00
D	7,200	41.00	40.00
E	150	98.00	50.00
F	65	110.00	50.00
G	1,800	90.00	33.00
H	1,500	102.00	40.00
I	900	75.00	27.50

Another element in favor of the range is that it, as a heavy current-using device, is perfected and well tried out commercially.

Thus as a first step in carrying out residence load building the electric range should be pushed. Experience shows that the range can be used most easily to secure the breaking down of the antipathy of customers to the use of heavy current-consuming devices and at the same time it is the best revenue-producing device to support a rebuilt distribution system. And it is also a matter of experience that ranges become more and more profitable devices to the utility as the saturation increases.

The electric range will use from 1,200 to 1,800 kw.-hr. per range per year and give an annual gross income

of from $48 to $72 per year at a four-cent rate. This can be compared to the 360 kw.-hr. used by the average lighting customer with a gross return of about $28 per year. The range and lighting combination is therefore good for a consumption of about 1,700 kw.-hr. and a gross return of $80 per year under average conditions.

"But what about investment costs and demand costs?" is a natural question which follows this statement. The utilities of this country carry an investment of about five dollars for each dollar of gross revenue. Some do better than this and many do much worse. Data show that the range business requires an investment of three dollars for each dollar of gross revenue in the pioneer ing stage and when charged, unfairly many think, with the whole cost of revamping the distribution system, the services and the meters. Once any degree of saturation is obtained, this investment decreases to less than one dollar per dollar of gross revenue. These data were obtained by executives who had to be convinced of their accuracy in order to be convinced the range business was profitable. They can stand the most rigid scrutiny. Table I shows reports from properties all over the country and the total investment covers every item of cost except the demand cost on the power station.

The cost to the system decreases as saturation increases. On one property costs changed from $150 to $125 to $75 in a period of four years as the saturation increased to 5 per cent. Naturally the return varied on the business from less than 1 per cent to 18 per cent during the same period. Another property found this cost had decreased from $140 to less than $100 in a period of three years. A glance at Table I shows this trend of decreased cost with time as evidenced by the low costs for those properties having a large number of ranges installed. It is reasonable to assume that a saturation of around 10 per cent will reduce the system investment to less than $50 per range. It should be remembered that these costs charge the range with all meter, transformer and primary, secondary and service wiring changes and that other loads can be added. Figs. 1 and 2 show this in a very striking manner.

At a $40 investment charge and with a four-cent rate one property has determined by rigid accounting that ranges give a return of 44 per cent on the capital investment.

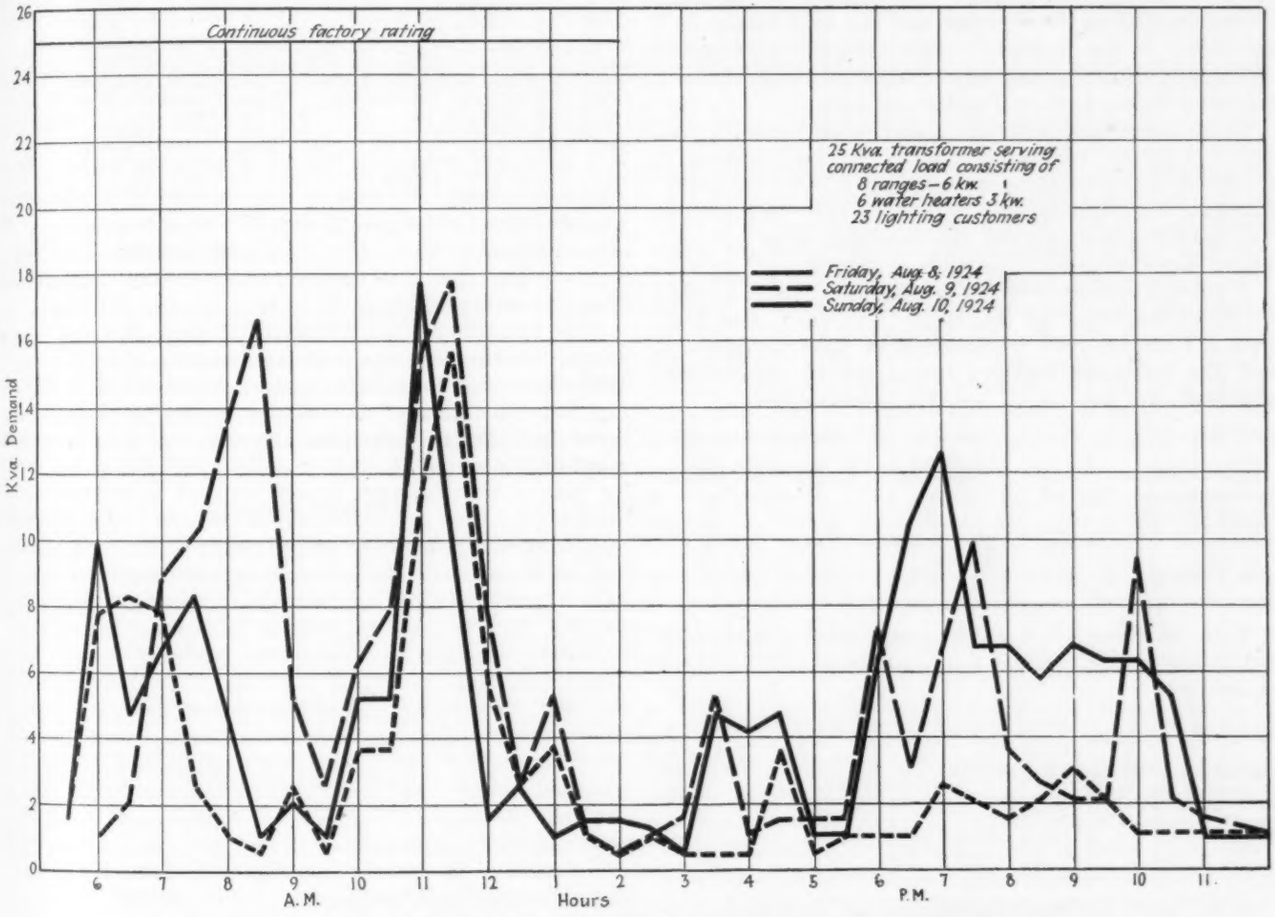


FIG. 2—SUMMER LOAD CURVE SHOWING A 25-KVA. TRANSFORMER SERVING EIGHT RANGES, SIX WATER HEATERS AND 23 LIGHTING CUSTOMERS

Investment costs based on peak demand responsibilities are difficult to determine and often are meaningless. Utilities find that the time and season of the system peak is a variable that fluctuates widely and cannot be predicted over a period of years. More and more load factor and diversity factor have come to replace peak responsibility as definite measures of business values.

A normal lighting service has a load factor of from 10 to 13 per cent, whereas the addition of a range raises the load factor to 20 to 23 per cent. A few ranges on a system will add about 1.75 kw. per range to the lighting peak when it occurs at certain seasons of the year, but with a large number of installations there will be a diversity of 10 to 1 and a demand per range of about 700 watts. Definite figures on one property show the

range returns $100 per kilowatt of peak demand as compared with $65 kilowatt of peak demand for industrial power loads. And this return is not affected by industrial depressions.

With a 5 per cent saturation on ranges another property reports a diversity of 5 per cent on the system and where more than ten ranges are used the demand is 1.5 kw. maximum. Another property with 1,500 ranges has an average connected load per range of 6.76 with a demand of 1.66 kw. Another company reports a diversity factor of 4.5 to 1 and a demand factor of 8 to 1. A diversity of 10 to 1 with a demand of 750 watts is reported for services to 100 ranges or more by another utility; still another report gives the average range demand as 40 per cent and the load factor as 6 per cent. In one instance a 7½-kw. transformer serves 70 kw. of ranges, appliances and lights, with the demand reaching 40 per cent only on baking days.

In an apartment with 62 ranges, each rated 7½ kw., and a lighting connected load of 62 kw., service is rendered to the combined loads by a 100-kva. transformer. The maximum demand for this load was 74 kw., giving a diversity for the combination of 7.13 to 1 under these favorable density conditions.

A typical system covering a wide area might be used to show the value of the range business. The total used investment may be assumed as $300 per kilowatt and the following relative allocations of investments and loads are not out of line for large systems:

Class of Customer	Per Cent of Investment	Per Cent of Output	Per Cent of Net Revenue
Domestic lighting	15	4	15
Commercial lighting	8	4	15
Commercial power	60	70	55
Street lights	4	1.0	4
Railways	4	3.0	3
Other utilities	9	18.0	8

With conservative conditions on such a system with a 1.75-kw. range demand a cost analysis would appear as follows:

	Per Year
Demand charge, 15% × $300 × 15% × 1.75	$11.80
Investment charge at $70 and 15%	10.50
Service charge, $1 per month	12.00
Energy, 1,500 kw.-hr. at 1.1 cents	16.50
Total	$50.80

With 1,500 kw.-hr. consumption at four cents per kilowatt-hour, the return per year would be $60, which is equal to slightly more than 18 per cent return on the business.

A utility with more than 7,000 ranges gives the data in Table II to show the diversity and transformer capacity for range loads. Table III gives the practice of another utility.

TABLE II—TRANSFORMER CAPACITY FOR SERVICE RANGES

Number of Ranges	Transformer Capacity, Kw.	Number of Ranges	Transformer Capacity, Kw.
1	1.5	6	1.15
2	2.0	7	1.10
3	1.75	8	0.9
4	1.5	9	0.85
5	1.25	10	0.8

Generally speaking, the maximum range load occurs at about 6 p.m., before the lighting peak, and is considerably greater than the morning range load. In Fig. 1 are curves which show the variable character of the residential load and the great diversity available.

TABLE III—CAPACITY FOR SERVING RANGE AND LIGHTING CUSTOMERS AS PRACTICED BY ONE UTILITY

Number of Ranges	Sizes of Ranges, Kw.-Hr.	Transformer Capacity to Install One Customer Only. No Secondary Supplied, Kw.	Transformer Capacity to Be Added to Lighting Demand of Secondary Circuits, Watts
1	4–5–6	5	3,000
1	7½–8	5	3,500
2	4–5–6	..	4,000
2	7½–8	..	4,500
3	4–5–6	..	6,000
3	6–7–8	..	6,500
4	4–5–6	..	7,500
4	7–8	..	7,500
5	4–5–6	..	9,000
5	7–8	..	10,000
6	4–5–6	..	12,000
6	7–8	..	13,000
7	4–5–6–7–8	..	14,000
8	4–5–6–7–8	..	15,000
9	4–5–6–7–8	..	16,500
10	4–5–6–7–8	..	18,000

Transformer capacities are computed on the basis of winter load conditions—namely, the coincidence of range and lighting peaks and the selection of sizes in accordance with this table. Allowable average overloading is 50 per cent, with a maximum of 75 per cent for one hour. The minimum size of wire for range services is No. 6. For ranges up to and including 8½-kw. rating a 25-amp., three-wire, single-phase meter is used. It has been found that secondaries designed to serve range loads adequately will meet lighting requirements.

Experience on properties shows that transformer capacity sufficient to care for range load will care for the lighting load also, but one or two properties add additional transformer capacity to care for the lighting.

The investment per kilowatt of peak demand for ranges is about the same as for domestic lighting, but this measure of investment cost or of load value is difficult to get accurately. It is almost impossible to allocate costs in order to determine the value of this investment over a period of time.

SALES AND SERVICES

During the pioneering period, sales costs on ranges are high, but with any degree of saturation or sale range merchandising is profitable. Utility after utility reports that the one best way to sell ranges is for the lighting companies to go into the business themselves and in addition co-operate with all other distributors. Payment plans are almost universal and the utility must co-operate with dealers and develop installation methods with contractors to see that ranges are properly installed. Above all, the utility should service ranges, for they require servicing in a volume next to that required in replacing fuses. The first year's cost to the customer is usually covered by a guarantee, but after that the utilities service for reasonable charges. Definite records from many properties show that the cost of each range inspected and serviced will be about $4 per range per year as a maximum. Sales plans and

TABLE IV—REVENUE AND CONSUMPTION OF DOMESTIC CUSTOMERS FOR ONE UTILITY

	Combined Lighting and Range Customers	Range Customers Only
Number of customers, Jan. 1, 1925	1,069	167
Number of customers, Jan. 1, 1926	1,530	269
Consumption for 1924, kw.-hr.	1,939,817	163,192
Consumption for 1925, kw.-hr.	2,925,146	296,339
Gained during 1925, kw.-hr.	985,329	133,147
Gain in per cent over 1924	50.8	81.7
Total net revenue, 1924*	$72,597.70	$6,315.03
Total net revenue, 1925*	$118,102.82	$11,934.26
Gain in 1925	$45,505.12	$5,619.26
Gain in per cent over 1924	62.7	89.0
Average revenue per kw.-hr., 1925, cents	4.04	4.03

* Gross revenue practically the same as the net revenue.

The average monthly bill per customer for 1925 was $6.91, with an average energy consumption of 157 kw.-hr. In this company there is only a slight seasonal variation in the monthly bills, due to the fact that in winter many of the homes having electric ranges are closed.

The total servicing cost for electric ranges during 1925 was $4,248, or about $2.36 per range.

TABLE V—REVENUE AND CONSUMPTION OF RESIDENTIAL LIGHTING CUSTOMERS WITH AND WITHOUT RANGES AND COMMERCIAL LIGHTING CUSTOMERS FOR ONE UTILITY

	Residential Lighting Customers with Ranges					Residential Lighting Customers Without Ranges		Commercial Lighting Customers	
Month of 1925	Energy Consumption, Kw.-Hr.	Gross Revenue, Dollars	Number of Customers	Consumption per Customer, Kw.-Hr.	Gross Revenue per Kw.-Hr., Cents	Consumption per Customer, Kw.-Hr.	Gross Revenue per Kw.-Hr. Cents	Consumption per Customer, Kw.-Hr.	Gross Revenue per Kw.-Hr., Cents
July	226,237	9,868	1,124	201	4.35	18.4	8.85	113	6.28
Ratio*	12.6	7.9	2.6	...	...	...	...	...	...
August	279,433	9,943	1,196	234	3.56	22.9	7.97	102	6.80
Ratio*	14.4	7.5	2.7	...	...	...	...	...	...
September	234,433	9,919	1,303	180	4.23	21.0	9.31	120	6.85
Ratio*	11.6	6.6	2.9	...	...	...	...	...	...
October	259,905	10,774	1,377	189	4.15	23.0	9.02	136	6.47
Ratio*	11.3	6.4	2.9	...	...	...	...	...	...
November	287,511	12,093	1,427	201	4.21	28.3	9.15	141	7.04
Ratio*	11.2	6.2	3.0	...	...	...	...	...	...
December	287,854	11,730	1,476	195	4.08	29.0	9.16	136	7.08
Ratio*	11.0	5.9	3.1	...	...	...	...	...	...
Weighted averages				198	4.08	23.7	8.95	125	6.77

* Ratio to total lighting and range, both residential and commercial. The residential lighting customers without ranges represent 78.0 per cent of the total number of customers during this period, and the commercial lighting represent 19.1 per cent, leaving the balance of 2.9 per cent for the residential lighting customers with ranges. Net revenues are about 4.75 per cent less than the gross.

merchandising methods are numerous, but continuous efforts with an occasional campaign by specialized salesmen work out best. Co-operative advertising, cooking schools and other sales aids are found advisable and helpful.

Rate Structure Must Fit Uses

Residential business requires a proper rate structure to develop. It is the form of the rate rather than the rate itself that is important. Rate studies show that those systems which have a continually developing business per residential customer both as regards consumption and gross revenue use a type of rate having a narrow first step and a low follow-on rate. Lighting on the average residence comes within a consumption of about 30 kw.-hr. per month, and about 60 kw.-hr. will cover the use of refrigerators, lights and small appliances, but the heavy current-consuming devices come within a monthly use in excess of 60 kw.-hr., and for their use a low rate is advisable. The width of the primary block is important rather than its magnitude, and the important part of any rate in its effect on consumption is the price for the secondary or usage block. Thus whether area charges, flat rates or block rates are used, it is important that the rate structure be made in a form that will encourage use of electricity. In other words, it is advisable to collect the investment charge at low consumption so that the greater energy use can be encouraged by a low follow-on rate.

Any rate form that will adjust itself to give a cost of about four cents for range consumption will be adequate to develop a profitable range business even on systems bearing coal entirely.

TABLE VI—RESIDENTIAL BUSINESS OF ONE UTILITY

Year	Kw.-Hr. per Year	Av. Rate per Kw.-Hr., Cents	Av. Rev. per Customer
1911	220	9.96	$21.90
1912	223	9.9	22.10
1913	213	9.97	21.25
1914 (rate reduction)	211	8.79	18.55
1915 (reduction ineffective)	219	7.33	16.05
1916 (another rate reduction)	233	6.72	15.65
1917 (reduction again ineffective)	260	5.89	15.30
1918 (commenced merchandising principally ranges)	283	5.68	16.10
1919	...	...	...
1920 (marked increases)	372	5.21	19.35
1921	434	4.86	21.10
1922	462	4.94	22.80
1923 (continued reduction in average rate due to ranges at 3 cents)	528	4.52	23.90
1924	537	4.67	25.10
1925	565	4.62	26.10

In eight years, 1917 to 1925, the annual revenue per customer was increased $10.80. Increased investment in distribution to get the business was less than the increased revenue increase. About 3,000 ranges connected with gross revenue per range of $45 and consumption 1,472 kw.-hr. Load factor of single range 4 per cent. Of a group of 150 or more, 20 per cent. The 3,000 range customers pay a gross revenue equal to 12,000 lighting customers. Cost of securing the range business is $20 per range in 1925. This includes sales promotion, sales, advertising, handling, accounting, collecting and other charges except intangible general office expense.

TABLE VII—RESIDENTIAL BUSINESS OF ONE UTILITY

Year	Kw.-Hr. per Year	Av. Rate per Kw.-Hr., Cents	Av. Rev. per Customer
1918 (few ranges)	245	6.8	$16.66
1925 (6,700 ranges in total of over 60,000 customers)	572	4.28	24.41
1925 (customers using ranges and lights)	2,059	3.03	62.26
1925 (customers using lights and small appliances only)	391	5.61	21.98

In seven years the increase in average revenue per customer was $7.76 with no rate changes. Range alone yields a gross revenue of $40 per year with a low rate block of two cents. Utility executive reports that a well-designed rate will treble the revenue of a customer installing a range and that the investment was increased at a much lower rate with a good range saturation. Total cost of selling 2,000 ranges in 1925 estimated at $10 per range.

Conclusions

All utilities should devote themselves to building residential business. Through the improvement of load factor and through direct revenues this policy will work out to be a profitable utility enterprise. Data from many utilities are available to show how to develop residential business profitably and to prove the value of this business.

The distribution systems of most properties are being revamped in order to meet load needs. As an aid to carrying this expense and as a device to break down sales resistance to heavy current-consuming equipment in the home the range is very valuable. Investment costs on ranges decrease rapidly with saturation and the bugbear of peak responsibility is based on opinion and not on facts. Ranges of themselves will increase the residential load factor 6 per cent and pave the way for other equipment which will still further increase load factor.

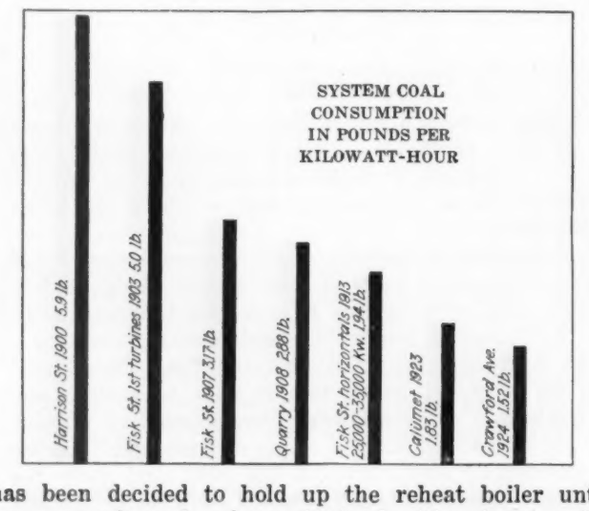
The return on investment per kilowatt for ranges at a rate that will encourage their use is equal to if not greater than that for industrial power loads. Data from many properties are now available to prove that the range is good business for all utilities and to show how range business is the best entering wedge to get greater residential business and to improve system load factors. The coming N.E.L.A. report on ranges gives added indisputable data on the value and characteristics of the range business.

Unit Fuel Expense Depends Chiefly on Cost of Coal

Amount and Cost of Coal per Kilowatt-Hour on the Commonwealth Edison System—Operating Performance of Crawford Avenue Plant

THE pounds of coal per kilowatt-hour, the cost of coal per ton and the cost of coal per kilowatt-hour for each year since 1900 are given in the accompanying curves for the entire Commonwealth Edison system. The improvement in station unit coal consumption is indicated by the graph. During the month of October, 1925, the unit fuel consumption of the system went below 2 lb. per kilowatt-hour, compared with more than 7 lb. per kilowatt-hour in 1901. It will be noted, according to W. S. Monroe, president of Sargent & Lundy, who made these figures available, that the cost of fuel per unit of output has been far more dependent upon the cost of coal since the beginning of the World War than on the fuel efficiency of the power station, and such undoubtedly will continue to be the case.

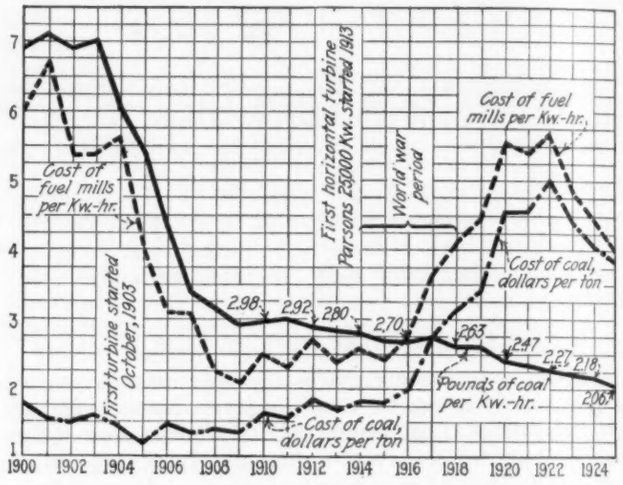
The foregoing performance was obtained with stations of varying age or modernity having about 885,000 kw. total generating capacity at the end of 1925. It should be understood that the latest of the Commonwealth Edison plants, the Crawford Avenue station, is not yet being operated under the conditions for which it was designed. As pointed out heretofore in ELECTRICAL WORLD, the station contains a 50,000-kw. Parsons unit, a 60,000-kw. General Electric unit and a 50,000-kw. Westinghouse unit. Although the General Electric unit was the first to go into service (Nov. 14, 1924), it did not go into operation with reheating until last May; the Westinghouse unit in July; and the Parsons unit has not yet been run with reheat for the reason that it


SYSTEM COAL CONSUMPTION IN POUNDS PER KILOWATT-HOUR
Harrison St. 1900 5.9 lb.
Fisk St. 1st turbines 1903 5.0 lb.
Fisk St. 1907 3.71 lb.
Quarry 1908 2.88 lb.
Fisk St. horizontals 1913 25000-35000 Kw. 1.94 lb.
Calumet 1923 1.83 lb.
Crawford Ave. 1924 1.52 lb.

has been decided to hold up the reheat boiler until some experience has been obtained with reheating for the other turbines.

During the first eight or nine months of the year operation was very difficult due to delays in getting boilers, fans and various other parts of equipment into service; some trouble was also encountered with tube joints of the economizer. One of the turbines is running now at somewhat reduced capacity and efficiency because of some blade trouble, recently developed. These experiences, although similar to those likely to be encountered in starting any large new plant, were aggravated by the unusual character of much of the equipment and the numerous details that were new and untried and had to be worked into operating condition, according to Mr. Monroe.

During the month of October the station had an output of 58,760,000 kw.-hr. and an efficiency of 1.54 lb. of coal per kilowatt-hour, equivalent to 15,400 B.t.u. per kilowatt-hour (the coal averaging 9,984 B.t.u. per pound). In producing this output the Parsons unit ran without reheat and at less than half load during the day and was shut down entirely at night. When all three units are finished and with improved load conditions on the station, it is expected to obtain the orig-



COMPARISON OF UNIT-FUEL COSTS WITH COST OF COAL AND COAL PER KILOWATT-HOUR

inally estimated efficiency of 15,000 B.t.u. per kilowatt-hour.

Low-grade coal from the central Illinois coal fields is employed, containing 15 per cent moisture and 15 per cent ash. The iron content is about 2 per cent, the sulphur 4 per cent and the hydrogen, not including that in the moisture, more than 4 per cent. The fusing temperature over the ash is low. Moreover, the coal is much slower to ignite than most coal, even those with similar analysis. The characteristics of the ash create a severe slag condition in the furnace and in the tubes of the lower part of the boiler, which contribute to limit both the capacity and the efficiency that can be obtained. The "hydrogen loss," or loss of efficiency, due to the latent heat of the moisture-forming hydrogen of the coal is 2½ to 3 per cent greater with this coal than with the higher-grade Virginia and eastern Kentucky coal. Furthermore, the furnace efficiency is 3 to 4 per cent less due to the high ash content and slag condition. These two factors are equivalent to just about 1,000 B.t.u. per kilowatt-hour in the coal rate, declares Mr. Monroe, so that with Eastern coal the company could expect to operate the Crawford Avenue station at between 14,000 and 14,500 B.t.u. per kilowatt-hour, compared with 15,000 and 15,500 with central Illinois coal, using stoker firing. With pulverized coal, the British thermal units per kilowatt-hour should be 400 to 500 lower.

Pulverized coal is not used at Crawford Avenue, declared Mr. Monroe, because the company preferred to "bear the furnace ills it had rather than fly to others that it knew not of," the high ash and high moisture content as well as the low British thermal unit value being the occasion for this remark. The problem of dust and smoke from the stacks of such a large plant

near the center of the city was also an important factor. Even with a fairly satisfactory solution of existing smoke problems with chain-grate operation, it has been decided to increase the height of the Crawford Avenue stacks 65 ft. because of complaint regarding the sulphurous gas issuing therefrom.

The station operates with a steam pressure of 550 lb. at the turbine throttle and a steam temperature of 725 deg. F. Compound turbines are used and the exhaust from the high-pressure turbines is taken back from the boiler room and reheated in separate reheat boilers. Steam is extracted from two or three stages for heating feed water, improving the cycle efficiency and increasing the available capacity of the turbine by taking work off the low-pressure wheels and reducing the size of the condenser. Vertical condensers are used largely to prevent the adherence of the slimy circulating water and thus maintain a better average vacuum.

Power Applications in Coal Mines

Brief Résumé of Practices Followed in 200 Mines Out of 338 Operated in the State of Illinois Showing Trend of Electrified Mines Using Purchased Power

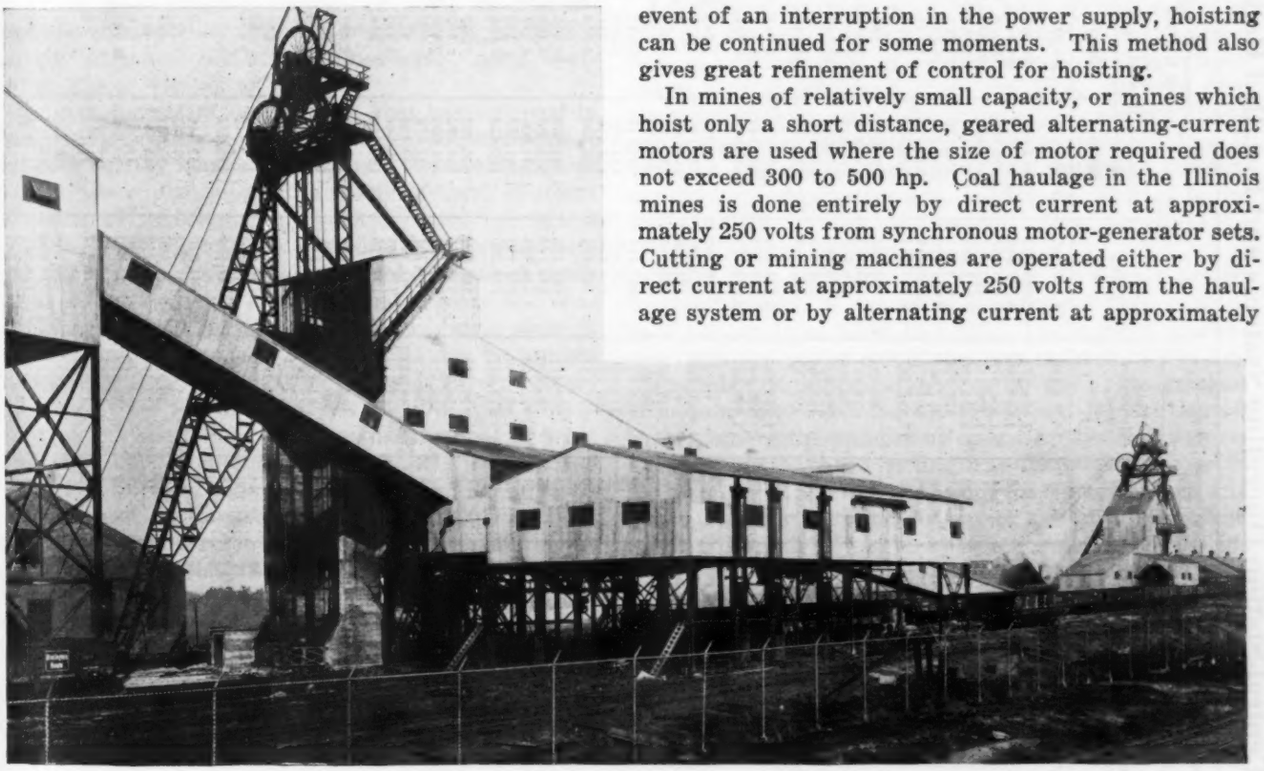


FIG. 1—LARGEST PRODUCING COAL MINE IN THE WORLD PURCHASES ALL POWER REQUIRED
New Orient mine of the Chicago, Wilmington & Frankfort Coal Company

THE chief requirements for power in operating Illinois coal mines are hoisting, haulage, cutting, ventilating, pumping, screening, repair shop and lighting. In the large mines of Illinois practically all the hoisting is done by means of a flywheel induction motor-generator set supplying direct-current power. The hoist itself is driven by a direct-current motor. An auxiliary alternating-current motor of relatively small capacity is provided for hoisting men and materials when the large motor-generator set is not in operation.

This method of driving the hoist, which is variously known as the Ward-Leonard or Ilgner system of control, provides a very steady average load for the alternating-current source and at the same time gives the effect of almost unlimited torque for hoisting purposes. One of the advantages of this system of control is that in the event of an interruption in the power supply, hoisting can be continued for some moments. This method also gives great refinement of control for hoisting.

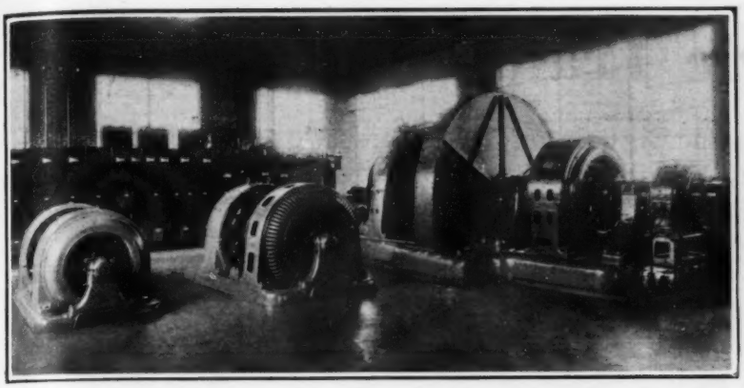
In mines of relatively small capacity, or mines which hoist only a short distance, geared alternating-current motors are used where the size of motor required does not exceed 300 to 500 hp. Coal haulage in the Illinois mines is done entirely by direct current at approximately 250 volts from synchronous motor-generator sets. Cutting or mining machines are operated either by direct current at approximately 250 volts from the haulage system or by alternating current at approximately 220 volts. Alternating-current cutting machines were first introduced into Illinois in 1913 following the introduction of purchased power. Their use permitted power at 2,300 volts to be taken underground by means of a three-phase lead-covered armored cable to banks of transformers located adjacent to the working faces in the mine. This arrangement greatly reduced the losses experienced on the direct-current system and also materially reduced the repairs on cutting machines; furthermore, full voltage is more readily assured. The majority of new mines in Illinois, during the last ten years, have installed alternating-current cutting machines.

Pumps for removing water from the mines are usually driven by alternating-current motors, although some electrically driven pumps are operated from direct-current haulage circuits. Ventilating fans are usually

Number of Central-Station Operating Systems and Installed Generator Rating

State.	Operating Companies (Jan. 1, 1926)			United States Census Data (Jan. 1, 1923)				Generator Rating (July 1, 1925)					July 1, 1925			
				Operating Companies					Alternating Current, Kva.		Direct Current, Kw.					
	Total Number	Light and Power Companies	Municipal Systems	Total Number	Light and Power	Municipal	Total Generator Rating, Kw.	Total, Kva.	Active	Reserve	Active	Reserve	Companies Purchasing All Energy	Cos. Purchasing and Generating Energy	Companies Which Furnish Day Service	Companies Which Do Not Furnish Day Service
United States	5,235	3,143	2,092	6,355	3,774	2,581	14,313,438	24,240,585	23,651,298	260,978	310,239	18,070	1,886	350	3,998	1,237
New England	356	292	64	365	290	75	1,456,574	2,065,002	1,912,823	89,609	57,770	4,800	164	58	292	64
Middle Atlantic	505	393	112	593	465	128	3,664,986	6,767,040	6,674,719	64,146	27,920	255	210	48	386	119
South Atlantic	674	380	294	765	371	394	1,356,478	2,874,457	2,829,306	18,519	25,717	915	224	39	463	211
East North Central	1,066	635	431	1,279	724	555	3,309,539	5,822,697	5,683,425	40,895	97,737	640	515	82	844	222
West North Central	1,279	521	758	1,722	802	920	1,171,496	1,822,989	1,762,188	13,887	46,604	310	476	50	1,009	270
East South Central	293	181	112	427	266	161	573,738	979,831	956,596	11,853	8,082	3,300	53	17	196	97
West South Central	526	339	187	625	419	206	461,984	987,330	956,246	14,839	16,245	0	68	11	387	139
Mountain	334	244	90	351	257	94	661,376	1,066,355	1,047,423	3,741	7,341	7,850	91	26	259	75
Pacific	202	158	44	228	180	48	1,657,267	1,854,884	1,828,572	3,489	22,823	0	85	19	162	40
New England																
Maine	73	67	6	82	75	7	89,983	197,187	196,030	587	570	0	38	10	51	22
New Hampshire	43	39	4	57	52	5	51,617	33,183	30,033	3,143	7	0	14	5	36	7
Vermont	65	52	13	57	42	15	96,866	119,753	116,019	2,712	1,022	0	28	12	48	17
Massachusetts	123	86	37	117	76	41	794,420	1,118,145	1,069,205	31,524	17,416	0	69	15	110	13
Rhode Island	10	10	0	8	7	1	163,900	214,035	176,000	0	38,035	0	6	2	9	1
Connecticut	42	38	4	44	38	6	259,788	382,699	325,536	51,643	720	4,800	9	14	38	4
Middle Atlantic																
New York	254	201	53	291	232	59	1,858,890	3,528,980	3,509,572	10,143	9,265	0	101	32	192	62
New Jersey	39	23	16	60	42	18	356,443	553,337	509,541	43,216	325	255	19	4	31	8
Pennsylvania	212	169	43	242	191	51	1,449,653	2,684,723	2,655,606	10,787	18,330	0	90	12	163	49
South Atlantic																
Delaware	14	6	8	†	†	†	†	40,200	37,457	343	2,400	0	3	0	10	4
Maryland	43	35	8	*54	*32	*22	*300,108	323,296	321,746	625	750	175	18	1	29	14
District of Columbia	3	3	0	†	†	†	†	121,000	118,000	0	3,000	0	2	0	3	0
Virginia	74	53	21	99	69	30	117,272	243,156	235,179	682	7,295	0	17	6	47	27
West Virginia	62	54	8	66	57	9	300,463	503,303	498,193	750	4,360	0	27	6	48	14
North Carolina	147	84	63	182	85	97	167,421	907,610	905,518	1,642	450	0	66	9	101	46
South Carolina	75	46	29	87	40	47	292,880	137,935	132,048	2,262	3,175	450	24	3	56	19
Georgia	156	47	109	176	43	133	107,213	464,466	454,656	7,481	2,039	290	44	10	93	63
Florida	100	52	48	101	45	56	71,121	133,491	126,509	4,734	2,248	0	23	4	76	24
East North Central																
Ohio	254	142	112	298	157	141	897,412	1,687,246	1,642,305	15,895	29,046	0	140	10	194	60
Indiana	184	108	76	212	119	93	335,450	594,740	585,103	4,405	4,667	565	111	12	149	35
Illinois	235	157	78	284	163	121	972,550	1,686,926	1,644,006	4,637	38,233	50	118	13	179	56
Michigan	171	94	77	232	125	107	691,080	1,067,495	1,061,587	352	5,531	25	39	10	133	38
Wisconsin	222	134	88	253	160	93	413,047	786,290	750,424	15,606	20,260	0	107	37	189	33
West North Central																
Minnesota	206	26	180	254	99	155	227,729	360,064	350,597	1,702	7,696	69	111	11	187	19
Iowa	195	96	99	294	148	146	236,036	531,706	509,874	6,857	14,908	67	99	17	155	40
Missouri	169	108	61	240	166	74	315,514	481,543	471,908	2,420	7,215	0	58	6	112	57
North Dakota	159	117	42	154	109	45	30,000	30,291	21,978	0	8,313	0	11	0	96	63
South Dakota	97	48	49	150	90	60	40,353	51,346	49,494	620	1,170	62	32	3	80	17
Nebraska	239	72	167	340	115	225	117,733	175,863	168,541	1,440	5,807	75	89	4	198	41
Kansas	214	54	160	290	75	215	204,131	192,176	189,796	848	1,495	37	76	9	181	33
East South Central																
Kentucky	90	72	18	138	111	27	103,361	234,634	227,128	2,697	4,809	0	17	2	56	34
Tennessee	76	51	25	110	69	41	166,761	144,452	143,972	450	30	0	16	6	50	26
Alabama	58	31	27	72	39	33	261,431	542,810	529,408	8,706	1,396	3,300	16	8	39	19
Mississippi	69	27	42	107	47	60	42,185	57,935	56,088	0	1,847	0	4	1	51	18
West South Central																
Arkansas	78	56	22	87	63	24	42,239	111,144	106,035	656	4,453	0	11	2	56	22
Louisiana	73	33	40	81	37	44	32,838	142,615	141,490	80	1,045	0	8	0	53	20
Oklahoma	123	49	74	167	67	100	121,100	161,718	152,749	7,522	1,447	0	22	5	86	37
Texas	252	201	51	290	252	38	265,807	571,853	555,972	6,581	9,300	0	27	4	192	60
Mountain																
Montana	50	47	3	64	57	7	227,253	341,840	332,645	0	1,345	7,850	9	3	33	17
Idaho	50	32	18	42	28	14	135,088	81,223	79,542	1,125	556	0	22	5	36	14
Wyoming	41	33	8	41	31	10	30,015	35,890	35,581	277	32	0	8	0	28	13
Colorado	79	47	32	79	51	28	112,590	249,758	244,996	414	4,348	0	21	9	66	13
New Mexico	25	23	2	31	26	5	15,178	15,546	14,861	0	685	0	2	0	21	4
Arizona	34	28	6	35	30	5	48,870	72,072	69,847	1,925	300	0	11	4	30	4
Utah	40	21	19	47	23	24	81,347	254,319	254,244	0	75	0	12	3	32	8
Nevada	15	13	2	12	11	1	11,035	15,707	15,707	0	0	0	6	2	13	2
Pacific																
Washington	82	68	14	80	66	14	362,576	264,905	250,453	746	13,706	0	37	7	66	16
Oregon	43	34	9	61	48	13	81,163	214,804	206,281	343	8,180	0	12	3	31	12
California	77	56	21	87	66	21	1,213,528	1,375,175	1,371,838	2,400	937	0	36	9	65	12

* Includes Delaware and District of Columbia. † Included under Maryland.



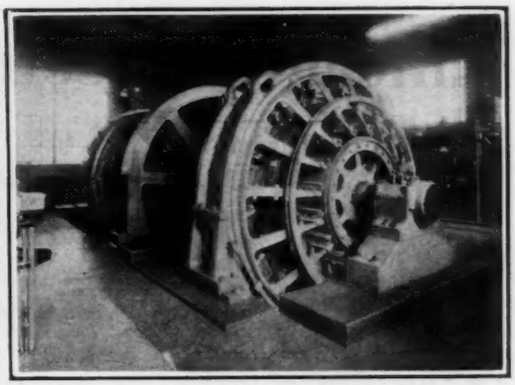


FIG. 2 (AT LEFT)—DIRECT-CONNECTED MOTOR-DRIVEN HOIST IN OLD BEN MINE NO. 8. FIG. 3 (AT RIGHT)—FLYWHEEL MOTOR-GENERATOR SET OPERATING OLD BEN MINE HOIST

driven by 220, 440 or 2,300-volt induction motors. Many of the fans are operated at constant speed, whereas other fans are run at adjustable speeds by means of pole-changing motors or some mechanical speed-changing device. The motors in the tipples of the majority of mines are alternating-current units operated at 220 or 440 volts.

One very important development that has occurred in Illinois is to locate motor-generator sets or transformer banks for cutting machines at or near the working faces of the mines and to supply the power of these locations by means of 2,300-volt three-phase cables through a drill hole from the surface immediately over the location. This method of power supply has enabled many mines to work comparatively remote areas and has lengthened the life of many mines by years, since it permitted recovery of coal which could not be worked satisfactorily from the shaft by means of direct current generated at the top of the shaft.

During the last two or three years a number of large strip mines have been developed in Illinois where satisfactory veins of coal have been found within 25 or 30 ft. of the surface. By the use of large electric shovels it has been found possible to strip the overburden and lay bare the veins. Smaller electric shovels load the coal into cars, which haul their burden to the tipples for preparation. In such mines power is required for operating electric shovels, for stripping and loading, for operating the tipple, and in some cases for pumping where natural drainage is not available.

This information was obtained from a résumé of practices made by the Central Illinois Public Service Company, Springfield, Ill.

Number of Operating Systems Greatly Decreased

A VERY clear picture of the long strides made by the electric light and power industry in the direction of centralization of control during the past three years is to be obtained from the table on page 656. This tabulation gives the number of electric light and power companies and municipal systems on Jan. 1, 1923, as reported to the United States Census Bureau, and the same figures for Jan. 1, 1926, as reported to the McGraw-Hill Publishing Company, Inc., for its 1926 Central Station Directory.

These data show that during this three-year period the total number of operating systems had been reduced by 1,120, or from 6,355 to 5,235. The number of electric light and power companies was reduced by 631 and the number of municipal systems by 489. The greatest reduction was recorded in the West North Central States, where the number of operating systems was reduced by 443. In no section was there an increase in the number of systems, although the New England and South Atlantic sections do report a slight increase in number of electric light and power companies during the three-year period.

The generator rating was increased by 7,390,000 kva. during the three-year period, using a power factor of 85 per cent for the census data of 1923. During the same period the energy output has increased by sixteen billion kilowatt-hours, or from 43,559,000,000 kw.-hr. in 1922 to 59,517,000,000 kw.-hr. in 1925. The highest rate of increase in generator rating was recorded by the South Atlantic States with 80 per cent.

FIGS. 4 AND 5—ELECTRIC STRIPPING AND LOADING SHOVELS USED BY UNITED ELECTRIC COAL COMPANY, CUBA, ILL.

Chicago's Electric Traffic Signal System

City Installs 280 Electric Traffic Signals on 136 Intersections at a Unit Cost of $625 — Provide Very Flexible Traffic Control — Require Only 586,000 Kw.-Hr. a Year on Present Schedule—System Control Is Unusual

By JOHN T. MILLER
Commissioner of Gas and Electricity, Chicago

THE volume of traffic in the downtown or Loop district of Chicago and at the various business centers of the outlying districts has grown so rapidly and to such an extent that it became necessary some time ago to devise a system of traffic control to take proper care of the situation. Consequently the superintendent of the Police Department, under which comes supervision and direction of traffic, requested the Association of Commerce to co-operate with him in determining the type of system that would best meet the requirements. This was done by appointing a committee, which conducted a number of traffic studies, its recommendations being subsequently approved both by the Association of Commerce and by the Police Department. These recommendations were turned over to the Department of Gas and Electricity to design the wiring arrangement and necessary equipment and make the complete installation.

It was recommended that four traffic signals be installed at each intersection and be placed as near as practicable to the building line, and that all signals be of the two-way three-color type. Furthermore, all of the signals in the Loop district had to be operated from one central control station and those at the outlying intersections by individual controllers.

All of the signals, for which an appropriation of $345,000 was allocated, have now been installed, the 49 Loop installations going into service Feb. 7, 60 of the outlying units before that and the remaining 27 on Feb. 15.

Loop Control Schemes

Co-ordination of traffic control in the loop is effected from the City Hall. The movement of traffic in each direction at each intersection starts and stops at a fixed time interval after zero time. The timing recommended, which of course depends on local traffic conditions, is shown in Fig. 3 on page 661. This scheme is based on a 90-second cycle. It will be observed that there are some intersections in the loop that operate under identical timing and that these particular intersections could be operated on the same circuit and on the same individual control unit in the central control station. However, actual operation may show that one of these intersections should operate on a slightly different timing. If so, it would be necessary to transfer this intersection to a circuit of like timing, or if there was no circuit of this particular timing, it would be necessary to install a new circuit. For this reason, and also to provide the greatest possible flexibility, it was decided to install a separate circuit for each intersection and to control each intersection from its own individual control unit in the central control station.

The traffic signal employed for all of the installations was designed by the Department of Gas and Electricity through the aid of Graham, Anderson, Probst & White, who gave their services to the city free of charge. A signal was developed that is considered to be very neat and of a distinctive appearance and one that will be identified as purely a Chicago unit. It is composed

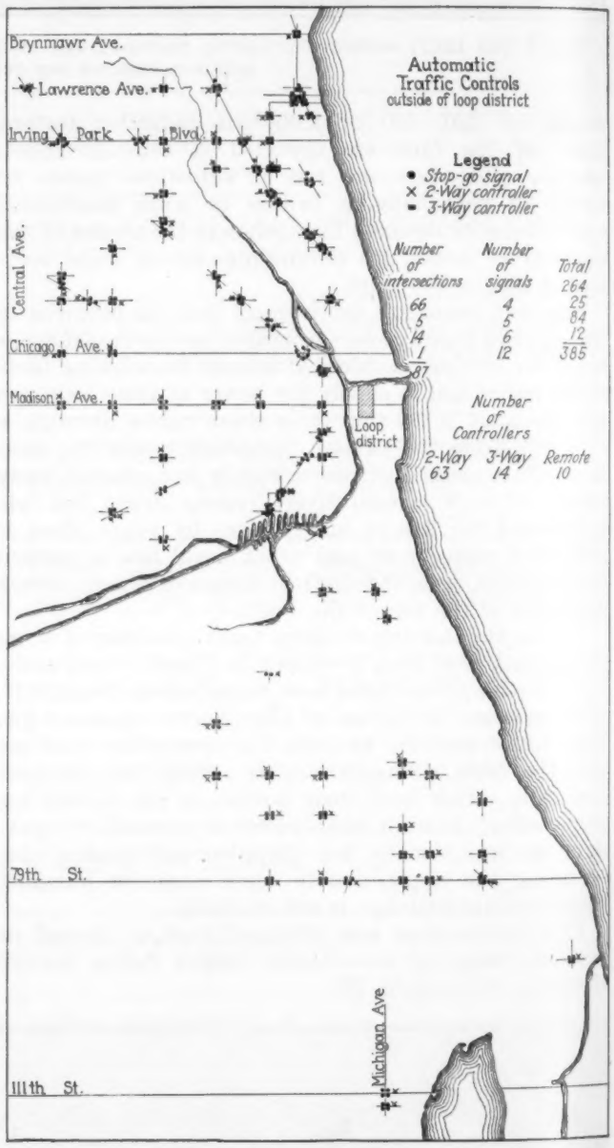


FIG. 1—DISTRIBUTION OF TRAFFIC SIGNALS OUTSIDE LOOP DISTRICT

Traffic studies indicated the need of electric traffic signals at 150 intersections outside the Loop in Chicago. Eighty-seven (indicated) have been equipped with a total of 385 units. Of these intersections 63 have two-way controllers, fourteen have three-way controllers and ten have remote control.

TRAFFIC SIGNALS AT INTERSECTIONS IN LOOP AND OUTLYING SECTIONS

There is one three-light, two-way unit on each corner on curb at stopping line. All Loop signals are controlled from the City Hall.

entirely of cast aluminum alloy and made in sections so that it can be readily assembled and repaired. The design allows changes to be made at the minimum expense to take care of any development that may be made in the design of traffic signals, such as the elimination of the amber light or the use of a new type of lens.

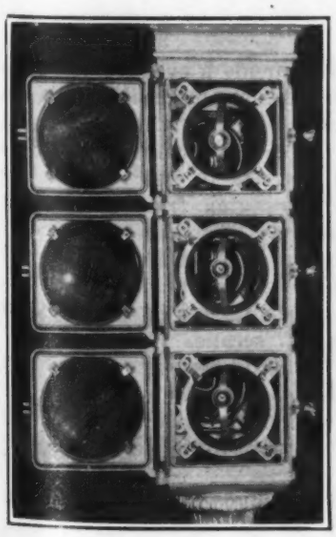
Three separate compartments are provided in each signal, with lenses of different colors in each compartment. Lamp replacements are made by merely opening a door to the compartment housing the defective lamp. The lenses are supported in the doors of the compartment. Two spider castings in each compartment serve both as reflector and socket holders, which are tipped 3 deg. below horizontal. The socket position can be changed very readily to place the lamp filament at the focal center of the reflector.

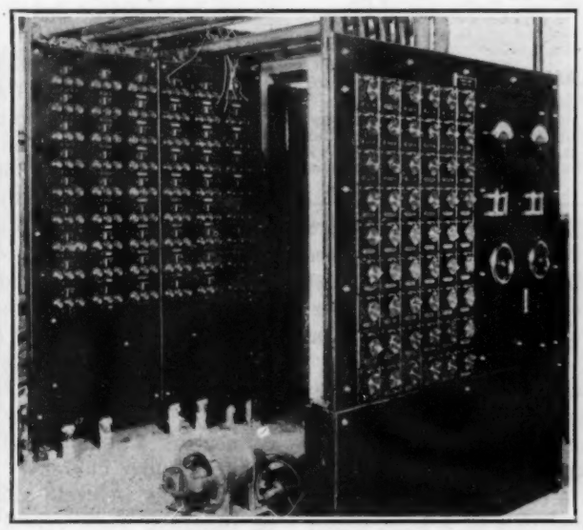
A special reflector with a heavy copper backing is used so that it will withstand abuse in handling and protect the silver coating from the effects of the Chicago atmospheric conditions. The signal is supported on a 5-in. steel pipe, which is securely fastened to a large flange, which in turn is bolted to the sidewalk or foundation. This flange is covered by a base casting.

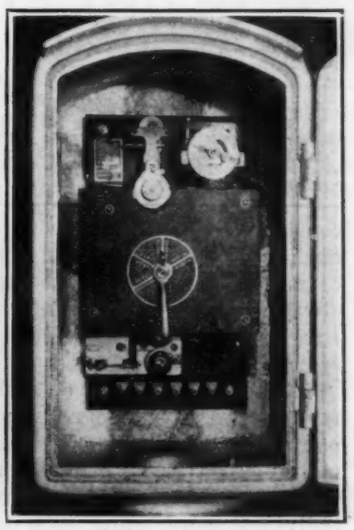
The lamps used in the signals are of the 50-watt, 110-volt, direct-current mill type. After careful consideration of the cost of energy and copper it was decided to use No. 10 conductors. Using this size of conductor, the line drop amounts to approximately 40 volts at the intersection farthest from the central control station. Therefore it is necessary to use a 150-volt supply of energy. For the remaining intersections where the line drop is under 40 volts a resistance is inserted in the line of an amount depending on the length of the circuit. Five wires are run to each intersection, one to be used for each color, one for the red and green neutral and the fifth for the amber neutral. Two neutrals are used to eliminate the drop in voltage at the signal when the amber light is burning simultaneously with either the red or the green light.

Ruby, amber and green lenses are used, with ruby at the bottom, amber at the middle and green at the top. The lap system of control is used on the amber light—that is, the amber or "caution" light never burns alone but for three seconds with the off-going color.

In the outlying districts, service is taken from the Commonwealth Edison Company alternating-current







CONTROL DRIVES FOR THE TRAFFIC SIGNALS

At the left is shown the method of supporting signal lenses, sockets and reflectors (latter removed to give view).

The view at the right shows the mechanism for adjusting cycle of operation and division of cycle. This standard controller is used in sections outside the Loop. As indicated, it affords manual or automatic control.

The middle view shows the central control equipment for 49 loop intersections. A main control board for adjusting cycle of operation and division of cycle at each intersection. In rear: facilities for transferring control of signals to reserve timer.

distribution system at 115 volts, and each intersection is operated independently except in cases where the signals are placed less than one-half mile apart. In these cases, the intersections are operated as a synchronized group.

All of the cable used is placed underground and incased in lead. The outgoing circuits from the central control station are all 40-conductor, lead-covered cable, which will accommodate eight intersections.

CENTRALIZED CONTROL FOR LOOP DISTRICT

The apparatus for the central control station had to be specially designed, and to the writer's knowledge similar apparatus has never before been developed. It consists of a combination of 54 individual controllers mounted on one frame and driven from a single source of motive power, as these individual controllers must always operate in a definite relation to one another. Five of these individual controllers are to be used as spares.

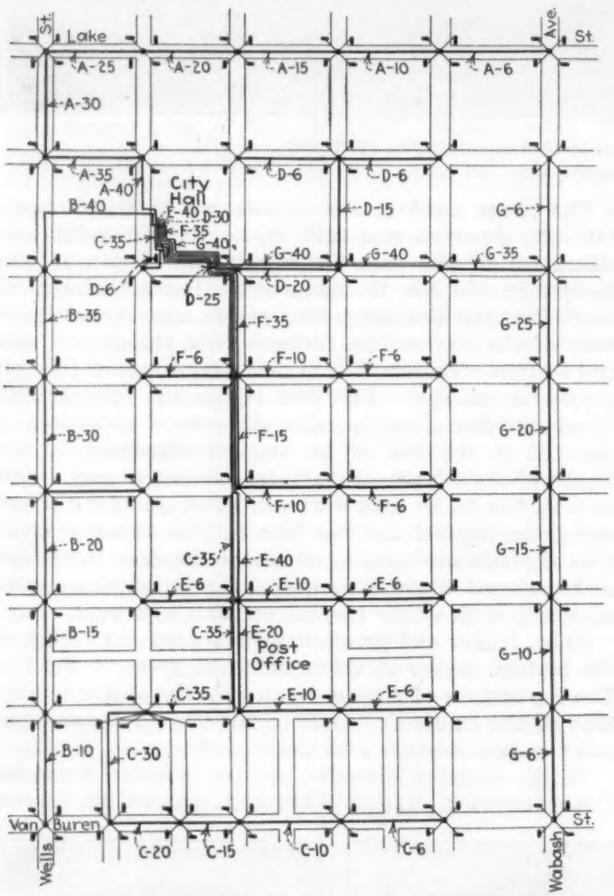


FIG. 2—ARRANGEMENT OF CABLES FOR SERVING LOOP SIGNALS

In this section, containing 35 full city blocks, are 49 intersections equipped with 196 traffic signals, all controlled from the City Hall. The letters followed by figures (for example, A-10) identify the cable and indicate the number of conductors in the cables.

The equipment involves a main control board, transfer and terminal board, resistance panel, five-panel power board and two 40-kw. motor-generator sets. The main control board supports an assembly of the individual controllers, driven from a common shaft by two individual power units, each consisting of a 1-hp. motor and a Reeves drive. The motor runs at constant speed, and the speed of the shaft from which the controllers are operated is adjusted by means of the Reeves drive. An electrical tachometer is inserted in each drive, and a meter, calibrated to show the revolutions or cycles per second of the controller shaft, is mounted on the face of one of the panels of the main control board. Hand control for the Reeves drive is mounted on the same panel so that in the event that it is necessary to change the cycle of operation of the signal system it can be accomplished very readily by the operator. Two separate drives are provided to insure continuity of operation. The individual controllers can be easily removed and a spare controller inserted in case of trouble.

Just back of the main control board is the transfer and terminal board supporting the terminals of all circuits. Each circuit is equipped with a plug and receptacle so that any signal circuit can be transferred to one of the spare control units in a very short time. With this arrangement, trouble can occur in five control units without interfering with the operation of the signal system. Busbars on the terminal board supply energy to the control circuits which operate the lights in the signals on the streets. Back of the terminal board is the resistance panel, which supports the units that are inserted in the signal circuits to provide the proper voltage at the signal.

The motor-generators serve to change the only source of energy in the City Hall (220-volt direct current) to the 150 volts required for the signal system. Direct current is used because a large battery, available for supplying auxiliary power for the City Hall in case of interruptions in the coming circuit, can be used to drive the motor-generator set or energy can be taken directly from the battery to supply signals by providing a 150-volt tap on the battery. As either motor-generator set is capable of supplying all the energy required for the system, the probability of any shutdown due to lack of energy is very remote.

INDIVIDUAL CONTROL FOR OUTLYING SECTIONS

Traffic signals at the outlying intersections are controlled by a separate controller at each intersection. Three different types of controllers are used—the two-way, three-way and remote controller. The two-way controller is used at intersections of two streets, the three-way at three-street intersections and the remote controller at two-street intersections in close proximity to an intersection being controlled by a standard two-way controller.

The two-way controllers provide a cycle of operation varying from 50 to 150 seconds and permit the division of any cycle at any point between 25 and 75 per cent of the total cycle. The three-way controllers provide a cycle varying from 60 seconds to 180 seconds and for a division of the cycle ranging from 20 per cent to 60 per cent of the total cycle. The remote controller consists of three relays operated by an impulse current supplied from a standard two-way controller. The duration of the amber light can be adjusted in the controller to any point between 0 and 7 seconds.

Energy for the lamps is fed directly to the remote controller as well as to the two-way and three-way controllers, so that the only current flowing over the cable connecting a remote control with a standard controller is the impulse current.

A change in cycle and the division of the cycle can be obtained very readily by the adjustment of dials on the controller panel while the controller is in operation. The mechanism consists of two coils with laminated cores operating a crossbar, which in turn

rotates a camshaft in one direction through the medium of a ball-clutch ratchet and escapement movement which limits the speed. The change in the cycle is obtained by moving the pivot point of the links connecting the crossbar and camshaft. The division of the cycle is made by moving the cams on the camshaft, as these cams operate the contacts that control the light circuit.

The controller is mounted in a watertight cast-aluminum housing supported on a steel standard of the same design as the signals. The shafts move very slowly, thereby eliminating excessive wear, and the coil arrangement eliminates the need of a high-speed motor with its ordinary troubles with bearings, commutators, etc. All of these controllers are equipped with hand-control switches so that a police officer can regulate the traffic by hand in the event of any emergency such as fires, parades, etc.

Energy Consumption and Demand

Based on 24-hour operation of the 385 units outside the Loop district with caution lamps burning 7½ per cent of each cycle, the annual consumption of energy from the point at which energy is taken for the signals, is about 415,800 kw.-hr., of which 2 per cent constitutes line and controller losses. The controller demand is about 33 watts for a two-street unit. The lamps actually average 54 watts apiece due to their being operated at overvoltage. When the correct voltage lamps are installed, the consumption will be reduced 8 per cent. Averaged over the 87 intersections involved, the total consumption is about 4,780 kw.-hr. per year for each intersection outside the Loop. This is not strictly correct, since 63 of the intersections have four units each, five intersections have five units each, fourteen intersections have six and one intersection has twelve units. The consumption per unit per year is about 1,080 kw.-hr., making the consumption for an intersection having four units about 4,320 kw.-hr. per year.

Based on a 7:30 a.m. to 12:30 midnight schedule for the 198 units in the Loop district during week days and 6 p.m. to 12:30 midnight for Sundays, the annual consumption will be about 169,770 kw.-hr., of which about 125,000 kw.-hr. is for the signals and about 45,000 kw.-hr. is due to losses in the cables and voltage-adjusting resistors at the central control station. These figures are based on 6,285 hours' operation a year and caution lamps burning about 7½ per cent of each cycle. Averaged over the 49 intersections involved, this consumption is about 3,470 kw.-hr. a year per intersection in the Loop. The consumption per unit is about 857 kw.-hr. per year. The foregoing figures on Loop consumption are based on actual consumption readings over the period now operated, and are lower than calculations would indicate because the lamps are operated at less than rated voltage. If they were operated at rated voltage, the foregoing figures would be increased about 7 per cent.

The maximum demand of the traffic signals depends entirely on the extent to which the cycles of operation at different intersections overlap one another. The continuous load per unit due to red and green signals is about 100 watts. For the red and green signals alone in the Loop the continuous load would be about 19.8 kw., to which must be added a fluctuating amount, depending on how much the caution periods overlap. The maximum demand could be 39.6 kw. if all the signals were synchronized, but this is not approached because of the timing employed. Under one condition of timing used the demand was about 22.5 kw. Similarly for the outlying districts the continuous load is about 38.5 kw., to which must be added a fluctuating amount depending on the overlap of cycles. Based on the base loads of the Loop and outlying districts, the annual consumption per kilowatt of base-load demand is about 8,570 kw.-hr. and 10,800 kw.-hr. respectively.

Method of Performing the Work

To determine the most efficient manner of installing the traffic signals and to ascertain the available underground ducts, a thorough field survey was made. The vacant ducts belonging to various public utilities were recorded, as well as those of the city. Permission was obtained from the Commonwealth Edison Company to use its available ducts on streets where there were no city ducts. This resulted in a very great saving and allowed additional signals to be installed. Work was started on Sept. 1, 1925, and progressed very favorably, as indicated by the fact that the Loop installation was in service on Feb. 7 and all of the outlying intersections on Feb. 15. Work in the Loop district could not be carried on as rapidly as in most other localities due to the congestion. The cost of installation per signal was approximately $625, or $2,500 per intersection. This figure includes all labor, material and overhead charges.

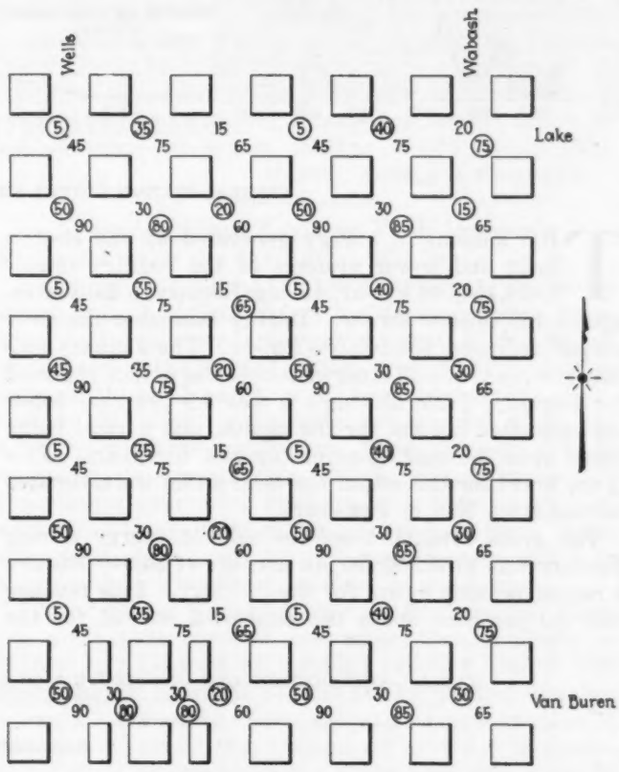
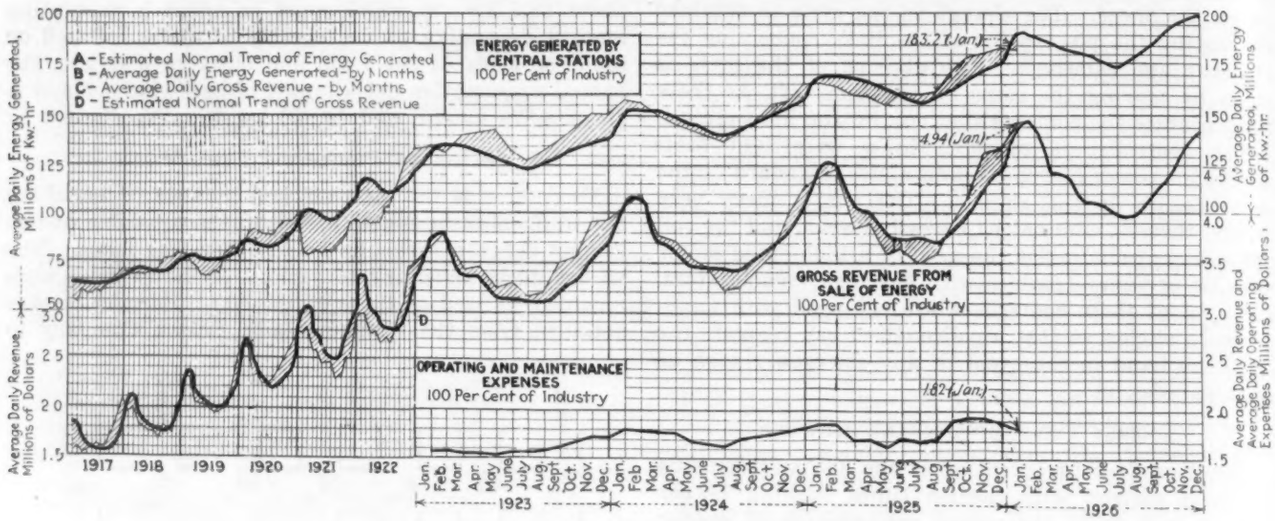


FIG. 3—TIME INTERVALS OF CO-ORDINATED LOOP SIGNALS

All intervals are computed from a zero time. Circled numbers indicate the start of east and west movements. Other numbers indicate the start of north and south movements. Complete cycle in 90 seconds. Amber signal lights five seconds before each change.

Elmer Stevens, chairman of the traffic committee of the Chicago Association of Commerce, the chief of police and Mr. McIlraith, staff engineer of the Chicago Surface Lines, have all expressed entire satisfaction with the operation of the system and to date the writer has failed to receive any real adverse criticism on its operation.

Record Central-Station Revenue During January


A - Estimated Normal Trend of Energy Generated
B - Average Daily Energy Generated - by Months
C - Average Daily Gross Revenue - by Months
D - Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
183.2 (Jan.)
4.94 (Jan.)
1.82 (Jan.)
Average Daily Energy Generated, Millions of Kw.-hr
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses Millions of Dollars
1917 1918 1919 1920 1921 1922
1923 1924 1925 1926

CENTRAL-STATION OUTPUT SHOWED A DROP DURING JANUARY

THE amount of energy generated by the electric light and power systems of the country totaled 5,678,156,000 kw.-hr. during January, a daily average of 183,200,000 kw.-hr. During December the daily output averaged 184,500,000 kw.-hr. The January output, however, was 10.8 per cent over the output reported for January, 1925, although it was 3.8 per cent below the estimated normal for the month, this normal being based upon the operations of the past five years. This is the first time the output has been under the estimated normal since May of last year.

The gross revenue from the sale of energy during January was $153,300,000, an average of $4,940,000 and a record revenue figure for the industry. This revenue was 2.0 per cent above the estimated normal for the month and was 11.8 per cent over that reported for January last year.

Of the total revenue it is estimated that $99,600,000, or 65 per cent, was received from residential commercial and street-lighting customers; $39,020,000, or 25.4

TABLE III—OPERATING RATIO OF CENTRAL-STATION COMPANIES

Month	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1925	1924	1925	1924	1925	1924
November....	46.0	46.2	24.8	25.0	42.0	45.0
December.....	45.6	45.8	26.0	27.4	41.8	44.0
	1926	1925	1926	1925	1926	1925
January.....	45.2	45.3	25.0	26.0	41.3	43.4

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
November..	5,391,857	4,690,975	14.8	4,349,857	3,785,975	1,202,000	1,124,000	2,615,857	2,141,975	532,000	520,000	1,042,000	905,000	996,000	706,000
December..	5,719,867	5,101,792	12.0	4,615,867	4,117,792	1,258,000	1,176,000	2,807,867	2,404,792	550,000	537,000	1,104,000	984,000	1,095,000	710,000
	1926	1925		1926	1925	1926	1925	1926	1925	1926	1925	1926	1925	1926	1925
January....	5,678,156	5,121,776	10.8	4,581,156	4,133,776	1,260,000	1,168,000	2,766,156	2,429,776	555,000	536,000	1,097,000	988,000	1,048,000	691,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
November	$139,300	$120,500	15.5	$91,400	$87,400	$34,400	$22,800	$4,720	$4,470	$8,680	$5,830	$55,200	$50,700
December	145,300	128,200	13.4	95,200	92,000	36,400	24,900	4,800	4,770	9,300	6,530	59,100	55,600
	1926	1925		1926	1925	1926	1925	1926	1925	1926	1925	1926	1925
January..	153,300	137,200	11.8	99,600	91,600	39,020	33,670	5,050	5,210	9,630	6,720	56,400	53,900

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES *
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Short Tons	1924 Short Tons	Per Cent Increase	1925 Barrels	1924 Barrels	Per Cent Increase	1925 Thousands of Cubic Feet	1924 Thousands of Cubic Feet	Per Cent Increase
November..	1,915,694	1,548,366	23.6	3,476,163	3,142,589	10.4	3,062,335	2,892,138	6.0	744,011	1,111,068	—33.2	4,182,000	4,536,881	— 7.7
December..	1,947,273	1,724,970	12.8	3,772,594	3,376,822	11.7	3,348,428	3,173,141	5.4	761,937	1,328,668	—42.8	3,671,437	2,940,598	+24.8
	1926	1925		1926	1925		1926	1925		1926	1925		1926	1925	
January....	1,923,480	1,676,536	14.8	3,754,618	3,445,240	9.0	3,288,170	3,230,153	1.7	962,701	1,329,855	—27.7	3,661,808	2,898,225	+26.5

* As collected by United States Geological Survey. The data are for the electric light and power industry only.

per cent, from power customers; $5,050,000, or 3.3 per cent, from electric railways, and $9,630,000. or 6.3 per cent, from other utilities which purchased energy for resale purposes.

The outstanding data for the past seven months relate to the energy generated in the hydro-electric plants of the country. In November these plants generated 23.6 per cent more energy than was reported for November, 1924, and January showed an increase of 14.8 per cent above January of last year. The fact must be remembered, also, that during the fall months of last year the output of the hydro plants in the Southern States was materially below the normal due to a severe water shortage. The steam plants of the country, on the other hand, reported an increase over the previous figure of 10.4 per cent in November and 9.0 per cent in January.

Letters from Our Readers

Power for Leipzig

To the Editor of the ELECTRICAL WORLD:

Our attention has been called to a short article in your issue for Jan. 16, page 150, entitled "Inadequate Supply of Electricity in Leipzig." This article refers to the rapid growth of the use of electricity in Leipzig and also to the difficulties on the part of the municipality in meeting the augmented demands. The electric distribution system in Leipzig, as is quite characteristic in Germany, is owned and operated by the city. A part of the power requirements is furnished by local municipal plants, but the larger portion is supplied by the Electric Power Corporation of Germany (Elektrowerke A. G.). In connection with the financing of the Electric Power Corporation we have been and are in possession of the facts relating to the company's operations and have been in very recent communication with the company relative to the Leipzig situation.

As mentioned in your article, there has been a rapid growth of business in Leipzig. As to a possible shortage of power supply for the city of Leipzig the statements in the article are quite at variance with the facts. The Electric Power Corporation has recently arranged to supply the additional power demands and has in fact been able to offer even more than the city felt would be its maximum requirements. Moreover, the company will be able to continue this arrangement as the city's load increases. In so far as Leipzig is concerned the city will have an ample supply of electricity at all times, including the period of the international fair which will be held this spring. The ability of the Electric Power Corporation to render this additional service to Leipzig has been of real assistance to the city as there is no doubt that a real shortage of power would have resulted had not the company been able to supply this need.

We are desirous of correcting the impression conveyed in the article that the power plants of the Electric Power Corporation have in any way been inadequate in supplying the customers' requirements as we have been advised that the company is experiencing no delays in making plant extensions, totaling 99,000 kw. in 1926.

New York. HARRIS, FORBES & COMPANY.

Allocating Fixed Costs on Peak Demands

To the Editor of the ELECTRICAL WORLD:

In an article published in the ELECTRICAL WORLD for March 6 A. S. Knight refers to "the well-known argument that since production investment is determined by demand at the time of station peak, fixed production costs should be allocated on the basis of demands occurring at this time" and admits the premise while disagreeing with the conclusion. It would seem that in accepting the premise Mr. Knight had in mind only fuel-electric generating stations, as is the case with all writers on the subject whose articles have come to my attention. The truth of the premise as applied to hydro-electric generating stations is questioned.

United States Geological Survey Professional Paper 123 gives 1925 costs of new steam-electric plants as $110.60 per kilowatt of installed capacity and of new hydro-electric plants as $151.90 per kilowatt of installed capacity. Accepting these figures as representative, it would seem evident that the amount by which the hydro unit cost is in excess of the steam unit cost must be charged to generation. For if the investment in plant were for the sole purpose of meeting the system peak, steam plant would serve as effectively as hydro and would be selected because of the comparatively small investment. Further, investment in hydro installation above the low-flow peak-carrying capacity of the plant is made for the purpose of replacing fuel-generated energy rather than fuel-plant capacity and is not properly charged to investment determined by demand.

It is concluded from the above consideration that only the equivalent investment in fuel-electric capacity to replace the low-flow peak-carrying capacity of a hydro-electric generating station is properly assignable to investment as determined by the system peak. For example: A hydro plant of 100,000 kw. installed capacity at $151.90 per kilowatt would cost $15,190,000. During low-flow conditions the capacity of the plant is only 45,000 kw., and at $110.60 per kilowatt the cost of this capacity would be $4,977,000. In other words, only 32 per cent of the investment in this plant is determined by demand and only 32 per cent of the fixed costs is assignable to customers' peaks, the remainder being properly allocated to energy charges. E. G. CRAIG.

Alabama Power Company,
Birmingham, Ala.

Central Station and Industrial Practice

Some Uses for Auto-Transformers

BY J. K. HIMES
Superintendent of Distribution, Dayton Power & Light Company

BESIDES using Type M auto-transformers to reduce lamp flicker*, the Dayton Power & Light Company has found such transformers very useful in maintaining voltage balance on secondary circuits and also, under certain conditions, for rural service extensions.

To maintain voltage balance, such auto-transformers are installed on the ends of long three-wire secondaries, connecting all three leads of the auto-transformer to the line. Because of the lower impedance of the auto-transformer compared with the impedance of the neutral between it and the main transformer, the auto-transformer will relieve the neutral and one outside wire of the burden of caring for out-of-balance current at 115 volts. As a result a smaller sized neutral wire can often be used and in some cases even smaller size 230-volt mains can be employed than would be necessary to deliver satisfactory service for badly unbalanced loads such as three-wire electric ranges. Ranges having a total connected load of 7 kw. are frequently connected to existing secondary circuits 500 to 600 ft. from a transformer without any change in the size of the secondary mains, the auto-transformer being installed at the point where the range service is tapped to the mains.

When rural service is requested 500 to 1,000 ft. beyond the last existing customer, Type M auto-transformers also have a useful service.

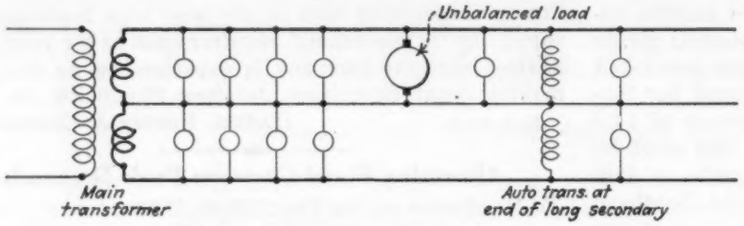


FIG. 1—AUTO-TRANSFORMER RELIEVES SECONDARY CIRCUIT IN SERVING UNBALANCED LOAD

In such cases a 230-volt, two-wire line will be extended to the point of service where an auto-transformer will be installed to supply either three-wire, 115/230-volt service or 115-volt, two-wire service. With wire at 18 cents a pound the cost of the compensator is about equal to 1,000 ft. of No. 6 wire, but the installation cost of the compensator is much less than that of the third wire where three-wire service is requested. Inasmuch as satisfactory service could not be delivered at 115 volts over this distance under any conditions, the cost of a primary extension is frequently eliminated by this practice. It is true that there is a small 24-hour core loss in the compensator, but it is considered that this is justified by the improved service and saving of the third wire or elimination of primary extensions and additional main transformers, which would be necessary were it not used.

*See article "Reducing Lamp Flickering with an Auto-Transformer," by W. F. Henn, page 207, Jan. 23, 1926, ELECTRICAL WORLD.

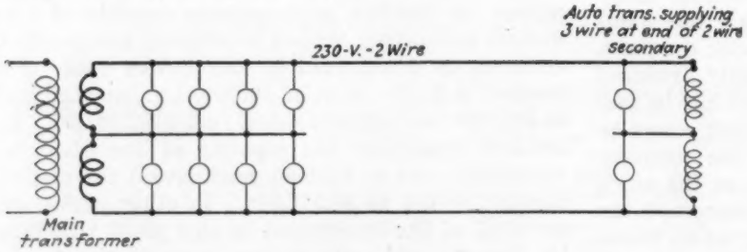
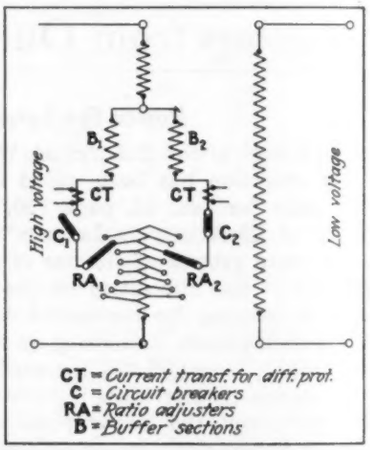


FIG. 2—SATISFACTORY RURAL SERVICE PROVIDED WITHOUT INSTALLING THIRD WIRE OR EXTENDING PRIMARY OR INSTALLING ADDITIONAL MAIN TRANSFORMERS

Tap-Changing Transformer with Eighteen Steps

BY A. PALME
Transformer Engineering Department, General Electric Company

A METALLURGICAL concern in the Niagara Falls district demanded a single-phase power transformer of 2,200 kva. at 25 cycles, to step down from 11,000 volts to voltages varying between 50 and 110 volts to feed an electric furnace. A total of eighteen voltage steps was desired. To permit a change from tap to tap without losing the load, the transformer for this equipment was made as shown on the accompanying sketch. The part of the winding that carries the voltage taps was so arranged as to have the tap leads brought out in a staggered way—that is, all the even numbers of taps are branched off to the right and all the odd numbers of taps are to the left. One ratio adjuster switch is provided for each half, so that two nine-point adjusters suffice for the desired eighteen positions.



INTERNAL CONNECTIONS OF EIGHTEEN-STEP TOP-CHARGING TRANSFORMER FOR ELECTRIC FURNACE ENERGY SUPPLY

Each adjuster is connected to an external circuit-breaking device, of which one is normally open, whereas the other is closed. The power circuit will thus be established through one of the adjusters and its breaker. If the tap is to be changed, the following operations must be performed:

1. Move the adjuster RA_1, on the

side of the open breaker, one point. This is possible, as no current flows in this circuit.

2. Close the breaker C_1. This will short circuit one tap section, but sufficient inherent reactance in the two buffer sections B_1 and B_2 limits this current to a moderate value. This fact, together with the very brief duration of this condition, makes this short circuit harmless.

3. Open breaker C_2.

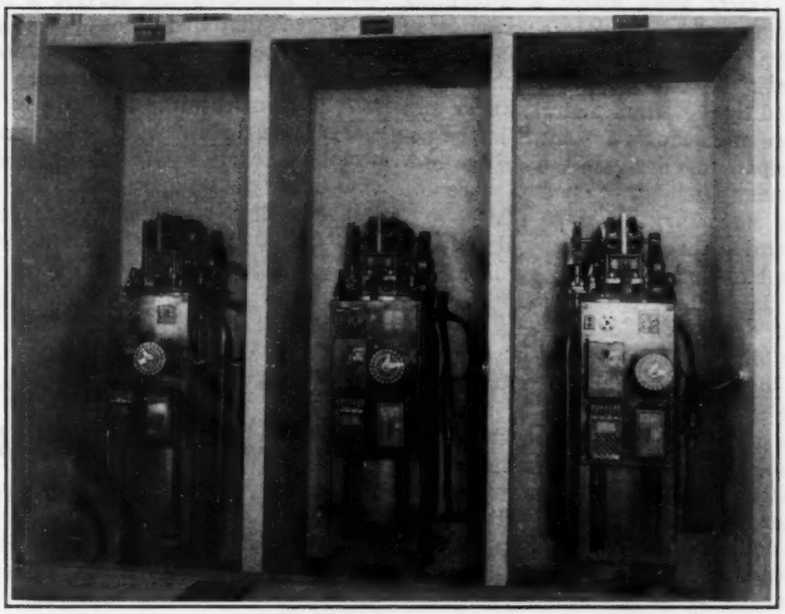
The proper sequence and timing of these operations are mechanically and electrically interlocked and are accomplished by a motor-driven gear mechanism in less than seven seconds.

The operating shafts of the two adjusters are mechanically coupled by an intermittent gear drive, so arranged that when the common middle shaft is turned at a constant speed it will first turn the left adjuster shaft and then the right adjuster shaft. Each adjuster is mechanically locked after it has made one tap turn. The common shaft of this gear is propelled by a simple wormwheel reduction gear and a small motor, mounted above the two adjusters. This same gearing carries a special camwheel against which rest the rollers of two lever arms. These lever arms are connected to wooden rods, which actuate two oil-immersed contactors. A differential relay is placed in the two circuit paths, with a time setting of several seconds. The internal circulating current in the short-circuited tap will actuate this relay, and if, for some reason, this current should persist beyond the allotted time, the relay would trip the main circuit breaker of the transformer.

From the power transformer are carried out eighteen leads which are connected to the twice nine leads of the two ratio adjusters on the changing mechanism. Since the apparatus was for indoor installation, no particular difficulty was experienced in bringing out these leads. Two push buttons have been provided on a small operating panel, a black button for lowering and a red one for raising the potential one step.

Depressing a button for about one second starts the mechanism and accomplishes a change of one step, whereupon the mechanism stops automatically. This one operation requires about seven seconds. When the mechanism arrives at the last tap position at either end, a limit switch comes into action, which stops the motor and blocks further operation in that direction. To indicate to the operator at any time at which tap the transformer is operating a remote position indicator of the electric Selsyn type is mounted on the operating panel, which is connected to a Selsyn generator driven from a shaft in the mechanism.

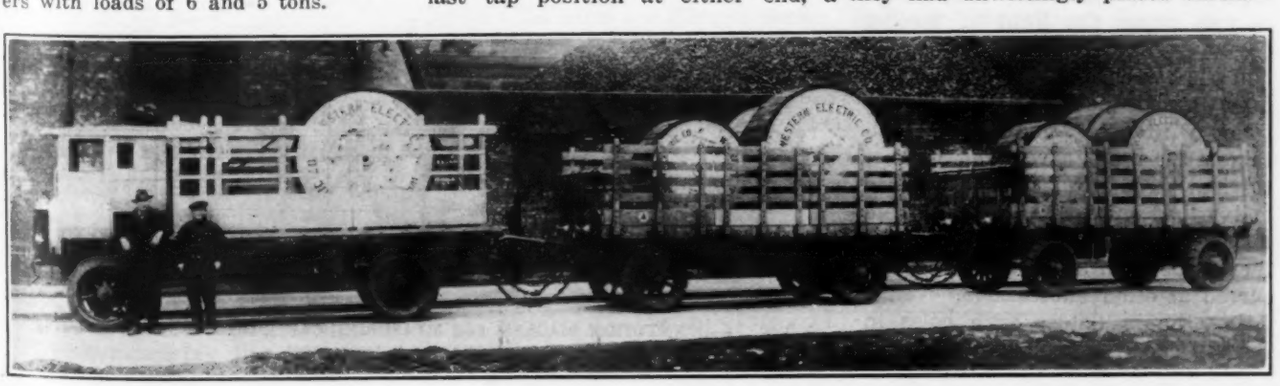
Concrete Regulator Cells Reduce Fire Hazard



ONE experience of the Public Service Company of Colorado with fire being communicated from one induction regulator to another has led this company to install regulators in concrete cells, as shown in the accompanying photograph. Each cell has an oil drain leading outside the building and any regulator fire will be localized. The regulators here shown are in the Harrison Street automatic distribution substation in Denver.

Cutting Transportation Costs on Cable

FOURTEEN tons of cable in one transportation movement. Four-wheel drive truck (F.W.D.) owned by Illinois Bell Telephone Company, carrying load of 3 tons and pulling two trailers with loads of 6 and 5 tons.

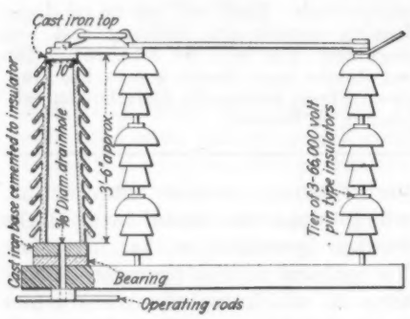


Insulators Form Nitric Acid

BY W. A. WATERS
Resident Electrical Engineer Manawatu-Aroua Electric Power Board, New Zealand

WHEN the first 110,000-volt lines of the Mangahao hydroelectric station in New Zealand were put into operation nearly a year ago little did the engineers suspect that they had unwittingly placed insula-

tors on the lines that turned out to be fairly good nitric acid-forming devices. The insulators in question were part of the 110,000-volt air break disconnecting switches supplied by a British manufacturer and were of the form as shown in the accompanying drawing. The two stationary insulation posts were of the customary pin type 66,000-volt, mounted three in a tier, and gave no trouble, but the offending members of the switches were really 110,000-volt oil switch bushings used without oil and with a dry flashover value of the order of 300,000 volts. After the system had been in operation a few weeks, a shutdown occurred one Sunday evening which was speedily traced to the switching tower of Bunnythorpe substation. The power station was asked to build up the line voltage again from zero, but the power station oil circuit breakers



DESIGN OF AIR BREAK SWITCH THAT ENTERED THE NITRIC ACID MANUFACTURING BUSINESS

tripped out again at 50,000 volts. A flame estimated to be at least 16 ft. long was seen to blow out of the bottom vent hole of one air break switch insulator. Again the power was built up, causing a flashover inside the insulator at 30,000 volts, while the last time the flashover occurred at about 11,000 volts. By this time the particular insulator had been noted, and as there was no sign of damage to it, the top cap was speedily removed. When this was done the nitric acid fumes were seen to rise under the light of torches freely and were exceedingly strong, and the inside of the insulator was covered with globules of nitrous solution with a fair quantity of solution on the rough surface of the base casting. The insulator was washed and wiped out dry internally and service restored. Subsequently further troubles of a similar nature occurred at other substations. Ventilating the insulators with holes in the top cap was tried, but this was not a success. Finally, in order to insure uninterrupted service a prearranged shutdown took place and about sixty of the rotating insulators of the air break switches were removed from the lines.

An experiment was being made when the writer left New Zealand consisting of filling the hollow insulators with a bituminous compound in order to get rid of the air space and so avoid the formation of nitric acid. The writer understands that similar air break switches are proposed for use in the United States and would submit that after the experience in New Zealand this design is unreliable. In the switches used in New Zealand the designer's intention (which was quite laudable) was to have an insulator which distributed the operating torsion stresses on a large radius, but the absence of oil filling converted the bushing to a first-class nitric acid-forming device.

Measuring Dielectric Loss in Reel Lengths of Cable by Portable Wattmeter Method

BY E. W. DAVIS and W. N. EDDY*

INCREASED recognition of the importance of dielectric loss tests upon paper-insulated cable in reel lengths has lately led to the development by two manufacturers of instruments of portable direct deflection wattmeters for this purpose, with marked savings in the time and labor required for such tests. Hitherto the small magnitude of the dielectric loss has made its determination a matter of considerable care and skill. For some time such tests were considered of laboratory caliber and were usually made on samples of cable 10 ft. long. As a result of the development of instruments above indicated, these tests can now be readily made commercially. With the old bridge method three skilled men were required, the test took about an hour for a single section of cable, and the cost of the bridge, air condenser and galvanometer used was about $1,700. With the new wattmeters one observer with high school training can make the measurement on reel cable with portable instruments in about five minutes and with an accuracy of 0.2 per cent.

Wattmeters have been developed for this service by the Rawson Electrical Instrument Company, Cambridge, Mass., and by the General Electric Company. The potential circuit phase angles of these instruments at 60 cycles are designed to be very small.

Fig. 1 is a diagram of a typical set-up for cable testing in the reel. The wattmeter is protected by a film

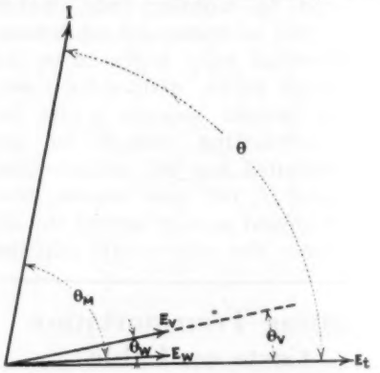


FIG. 2—VECTOR REPRESENTATION OF CORRECTIONS FOR WATTMETER METHOD

*Engineering Department, Simplex Wire & Cable Company, Boston, Mass.

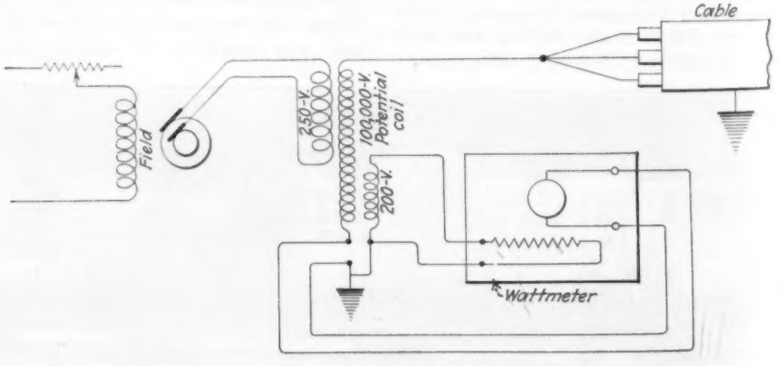


FIG. 1—CONNECTION DIAGRAM FOR MEASURING CABLE DIELECTRIC LOSS WITH PORTABLE WATTMETER

cutout against excess voltage in case of a cable breakdown. When using either of these wattmeters in making dielectric loss measurements, the following corrections must be made:

1. I^2R loss in the current circuit.
2. Phase angle displacement of the potential circuit of the wattmeter.
3. Phase angle between the voltage impressed on the cable and the voltage impressed on the wattmeter.

The first correction is obtained from curves furnished with the instruments, as are also the second and third, which are shown in the vector diagram, Fig. 2.

Let E_t = Transformer terminal voltage impressed on the cable.
E_v = Voltage impressed on the wattmeter.
E_w = Voltage as measured by the wattmeter.
I = Total current delivered by the transformer into the cable (referred to as charging current).
θ = Actual power factor angle between the charging current and the voltage on the cable.
θ_v = Phase angle displacement of the voltage impressed on the wattmeter with respect to the voltage on the cable.
θ_w = Phase angle displacement of the potential circuit of the wattmeter.
θ_m = Phase angle as calculated from current and wattmeter readings without applying any phase angle corrections.

Let W_m = reading of wattmeter minus the I^2R correction for the current circuit.
I = measured charging current.
E_t = measured voltage.

$\cos \theta_m = W_m \div (E_t \times I)$
$\theta = \theta_m - \theta_w + \theta_v$
Actual P. F. $= \cos \theta$
Actual watts $= \cos \theta \; W_m \div \cos \theta_m$

Excelsior Filter Used in Water-Treating System

EXCELSIOR has been used as a final filter for several years in the water-treating system of the Union Electric Light & Power Company's Ashley Street station in St. Louis, Mo.

The accompanying diagram shows the general sequence of treatment of Mississippi River water to be used for make-up boiler feed. As the water comes from the service pumps iron and lime are introduced into it in varying amounts according to the daily analysis showing the sediment in the water and the scale-forming mineral content. Barium hydrate is added at the end of the second basin to complete the softening process. By means of the bulkheads shown, the water is delivered to the bottom of each tank so that suspended matter will be precipitated. It is finally allowed to flow horizontally through the excelsior filter as shown in the diagram. About twenty-five bales of fine excelsior make up the body of the filter, which is 12x13 ft. x 4 ft. deep. The excelsior is turned over and washed out with a water jet three times a year and is renewed entirely once a year. The filter is found filled with impurities, and it has been demonstrated that the excelsior is more satisfactory as a filter than charcoal or other similar materials. Since the Ashley Street station serves the city steam-heating system, a large amount of make-up feed is necessary in the winter months, but the water-treating system here described has kept scale-forming impurities down to a minimum.

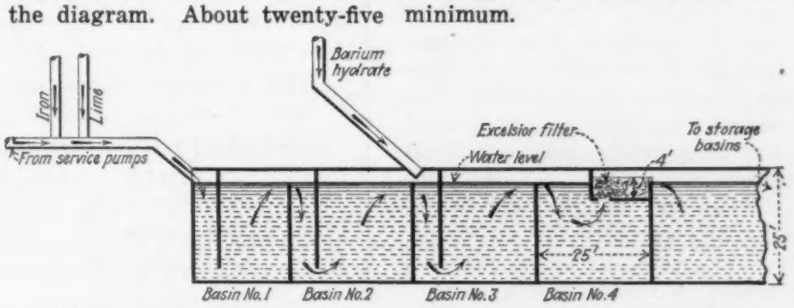
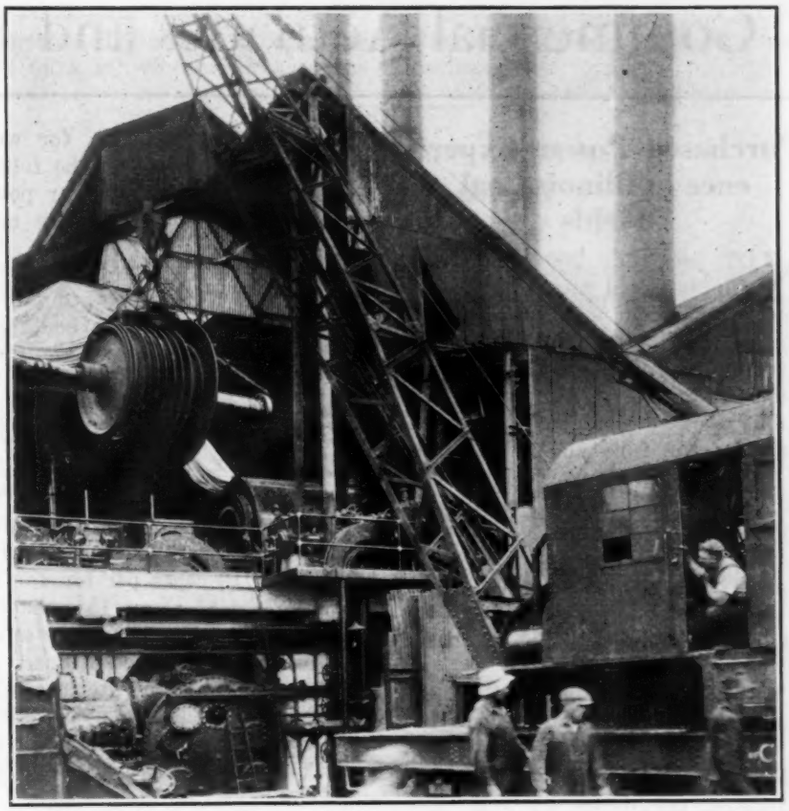


DIAGRAM OF WATER-TREATING SYSTEM AT THE ASHLEY STREET STATION

Removing Turbine Rotor with Locomotive Crane



THE method used by the Public Service Company of Colorado in removing the rotor of a 7,500-kw. steam turbine with a locomotive crane used for handling coal suggests the possibility of economy in small power-plant design by making a section of the roof removable and handling heavy equipment with an outside crane when major repairs are necessary.

Commercial Activities and Public Relations

Purchased Power Experience in Illinois Coal Fields

NOT less than 200 out of 338 shipping coal mines in Illinois now obtain all or a substantial portion of their power from purchased sources, according to J. Paul Clayton, vice-president Central Illinois Public Service Company. The majority of the fully electrified mines of the state have a very large output, hence probably at least 75 per cent of the coal mined in the state is mined wholly or partly by purchased power. This situation exists despite the fact that no mine in the state was operated by purchased power prior to 1910.

The power consumption of the mines that are completely electrified ranges from a minimum of about 2.1 kw.-hr. per ton for extremely favorable conditions of very constant operation up to 4.5 kw.-hr. per ton for unfavorable conditions. The average for the state is about 3.5 kw.-hr. per ton. Considered for individual mines, the power consumption varies according to the depth of the mine, average distance of haulage, amount of water pumped, thickness of veins and other conditions of relatively less importance. In two completely electrified mines removing approximately one million tons each per year from a depth of 400 ft., the actual power consumption for a year's operation was as follows:

Operation	Consumption Kw.-Hr. per Ton of Coal Hoisted	Per Cent
Hoisting	0.6	25
Haulage, gathering, cutting and pumping	1.4	58.3
Fan, tipple and shop	0.4	16.7
Total	2.4	100

The total operating cost for power where all is purchased will vary from about 7 cents per ton for very favorable conditions of large output and very constant operation to about 10 cents per ton for less favorable conditions and less constant operation. An average for the state would be about 8½ cents per ton. Compared with all other costs of mining coal, particularly labor, the cost of purchased power is the lowest expense in the mine for work done. This is shown by the following total operating costs for power for the two mines previously mentioned:

	Cost per Ton of Coal Hoisted (Cents)
Operating labor, including hoisting engineers, firemen, janitors, etc	1.5
Purchased power, coal for heating, water for wash-house, lubricants, etc	5.8
Repairs, supplies and miscellaneous	1.0
Total	8.3

The total operating cost for power from steam-generating plants operated by individual mines varies from about 10 cents per ton for the efficient plant to about 15 cents and even 20 cents per ton in many mines with less favorable conditions. An average for the mines of the state where power is used for all operations would be about 12 cents per ton. The cost varies because of the same conditions outlined above.

Actual average power cost (exclusive of overhead charges on power plant) for several mines having very efficient steam plants and operating under conditions averaging those for the state in normal times are as follows:

	Cost per Ton of Coal Hoisted (Cents)
Operating labor, including hoisting engineers, firemen, coal passers, oilers, janitors, etc	3.6
Coal, water supply, operating supplies, lubricants, etc	4.5
Repairs, repair labor, supplies and miscellaneous	2.2
Total	10.3

It may be pointed out that more than 62 per cent of Illinois is underlaid with bituminous coal, of which about 70 million tons is being taken out per year, although approximately 90 milllion tons was mined in 1918. The veins now being worked range from 3 ft. to 14 ft. in thickness. The depth of the coal varies from where the coal outcrops on the surface up to 1,000 ft. below the surface. The average depth of coal now being mined is about 400 ft. Most of the coal mines in the state are relatively dry.

Effect of Artificial Light on Egg Production

EXPERIMENTAL work that proves conclusively that artificial light will increase egg production very materially has been carried out by the Alabama Extension Service at the Alabama Polytechnic Institute, Auburn, Ala. In five weeks' time egg production from 960 hens increased 59 per cent under artificial light. This work is being done on the poultry farm of the institute and was undertaken to stimulate poultry production throughout the state.

On Oct. 26 of last year an egg-laying contest was started at the institute consisting of 96 entries of ten hens each. These entries were not only from the State of Alabama but also from other states, and one entry was from England. To house these hens 48 laying houses were constructed, each with two separate compartments. An entry of ten hens was put in each compartment. On Jan. 15 of this year a 50-watt lamp was installed in each compartment. The lights were first turned on at

Key to Good Will

GOOD *service to the consuming*
PUBLIC *is necessary before friendly*
RELATIONS *are possible, but customers*
REQUIRE *in addition to the product delivered*
SOMETHING *that assures dependability, some*
TANGIBLE *evidence of safety and high efficiency*
BEHIND THE *plant and equipment. They are entitled to*
COURTEOUS *treatment from each employee who makes*
CONTACTS, *however slight, with the consuming public.*

—WISCONSIN UTILITIES ASSOCIATION.

8:15 p.m. on Wednesday of the twelfth week of the contest for a period of fifteen minutes, during which time the hens were driven from their roosts and fed a small portion of hot mash. The time was gradually increased each night until at the end of the week the lights were turned on one hour each evening from 8:15 to 9:15 and the hens fed hot mash. The resultant increase in egg production during the next five weeks is given in the accompanying table.

EFFECT OF ARTIFICIAL LIGHTING DURING EGG LAYING CONTEST IN ALABAMA

Week	Egg Production	Increase	Production, Per Cent	Increase Over Preceding Week, Per Cent
Eleventh week...	2,928	...	43.5	....
Twelfth week...	3,162	234	47.55	4.05
Thirteenth week	3,542	380	52.7	5.15
Fourteenth week	4,032	490	60.0	7.3
Fifteenth week..	4,447	415	66.6	6.6
Sixteenth week..	4,645	198	62.28	2.69

At the end of this time the production had increased from 2,928 to 4,645 eggs per week, a total increase of 1,717. Eggs were selling at this time for 70 cents per dozen, so the increase represented an increase in gross revenue from the 960 hens of $100 per week. The energy consumed during the five weeks was 148 kw.-hr. and at a rate of 9 cents per kilowatt-hour this would amount to $13.32. In addition to the cost of electricity there would be a cost of labor and feed, but with all costs included there was still a net increase of $75 from the 960 hens for the five-week period. There are no definite data from which conclusions can be made as to how much of the increased production is directly due to the artificial lighting, but it is definitely proved by these results that prolonging the feeding period by means of lighting during the short days of winter increases the egg production. One important factor is the increasing of production at the time that eggs are the highest in price.

A Farm Power Truck

BY CHARLES H. CHURCHILL, JR.
Director Rural Extension and Farm Service Division
Adirondack Power & Light Corporation

IN ENDEAVORING to apply power to farm operations generally cognizance must be taken of the fact that there are numerous jobs that can be done with a 5 or 10-hp. motor but that do not require more than from three days to three weeks each year. The poor load factor offered by any one of these jobs would not justify the farmer's investment in a motor nor would it compensate the power company for the permanent installation of a suitable transformer. In order to enter this field for the purpose of gaining experimental data and also to increase the business on rural lines the outfit described here was built by the Adirondack Power & Light Corporation.

Fig. 1 shows the power truck as it was towed to a farm near Glens Falls, N. Y. The outfit was placed near a pole, then separated as shown in Fig. 2. The rear end of the old Ford chassis bearing the electric motor was then wheeled, wheelbarrow fashion, to the silo in the barnyard about 100 ft. away, to be belted to a silo filling machine.

Fig. 3 shows the wiring diagram and will give a general idea of how the equipment operates. The old Ford chassis with pneumatic tires was used because it was desired to tow the outfit from farm to farm at good speed over various kinds of roads without spilling the transformer oil or breaking the kilowatt-hour meter. The frame was made separable so that the transformer and front wheels could be left near a pole with primary voltage and the rear wheels and motor taken to the job. The two parts are connected by 200 ft. of No. 6 stranded twin conductor cable with extra heavy rubber and jute covering. The cable operates at 220 volts and is fitted at ends with heavy attachment plugs.

The 10-kva. transformer which is underslung behind the front axle is connected on the primary side through cartridge fuse primary cut-outs to twin conductor arc cable, which in turn is connected to the bare primaries by means of spring clamps. On the secondary side the transformer is connected through a steel-inclosed double throw switch to a watt-hour meter and from the meter to one of the heavy cable attachment sockets.

The 10-hp., single-phase, repulsion induction motor is connected through a no-voltage and overload relay device to the other heavy cable plug. A push-button control is a part of the relay equipment, as shown in Fig. 3.

In Fig. 2 may be seen a hoe handle bearing a pin-type insula-

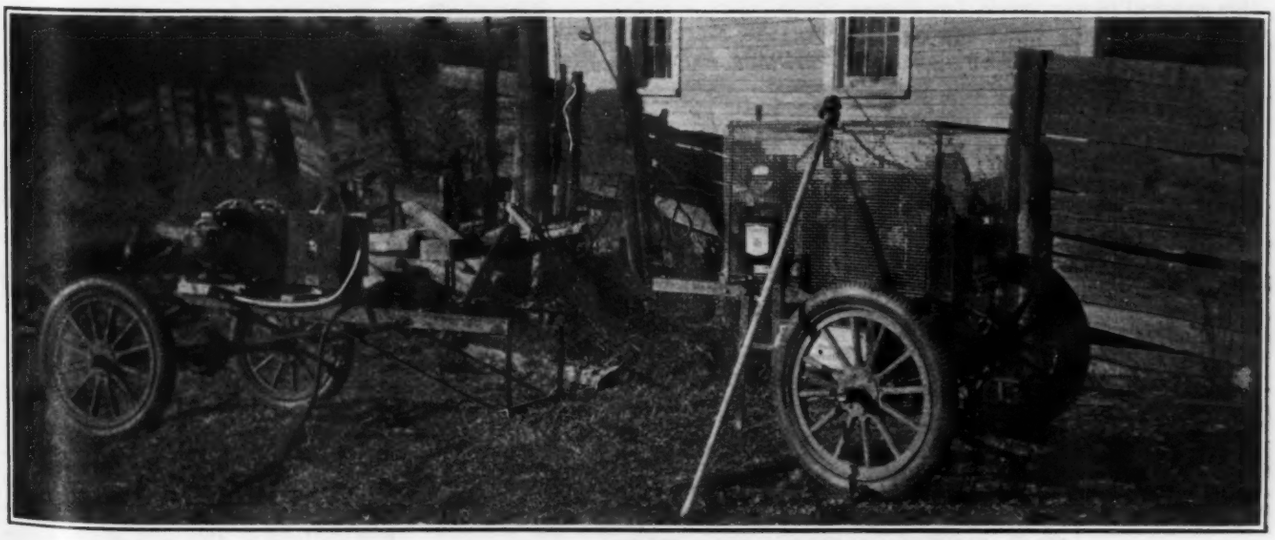


FIG. 1—THE POWER TRUCK AS IT ROLLS UP TO THE FARM GATE

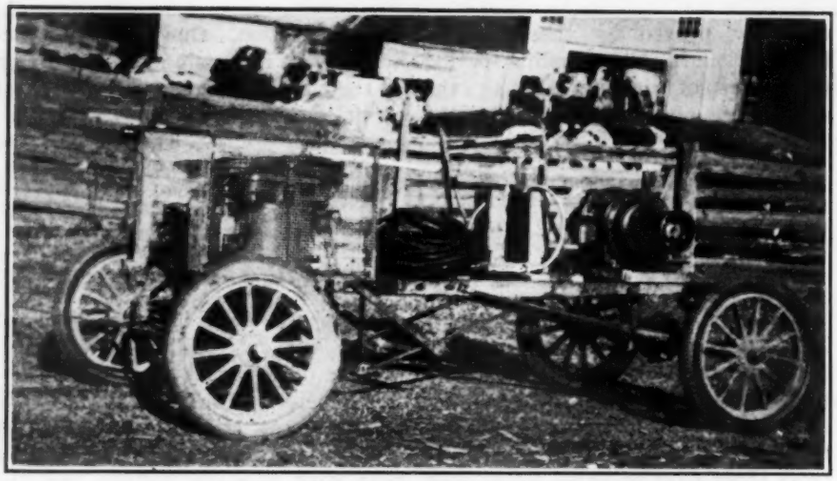


FIG. 2—THE TRUCK SEPARATED AND READY TO GO INTO ACTION

tor around which is a piece of heavy wire formed into a hook. This stick is used to connect the high-tension cable to the primaries from the top of a ladder which is leaned against the pole, thus making it unnecessary to have a lineman present.

In case of undervoltage or overload the relay will open the circuit. In case of other trouble the circuit may be opened by pushing the control button near the motor, by opening the double pole switch at the meter, by yanking free either end of the 220-volt cable or by opening the primary cutouts. The high-tension end of the truck is inclosed in wire mesh for added safety.

This outfit, which may be taken from farm to farm for temporary jobs such as threshing, silo filling, hay pressing, etc., is rented out on the basis of $6 for the first day, $4 for each additional day and 5 cents per kilowatt-hour for all energy used.

A similar outfit was built prior to this general power truck, but it was designed only for wood sawing. A 5-hp. motor and saw frame are fastened rigidly to the rear half of the chassis, thus maintaining a proper belt tension and alignment. A heavy cable connects the motor to a 5-kva. transformer, which, with the front wheels, is near a line pole. This outfit will saw three cords of hard wood per hour at an energy consumption of 1 kw.-hr. per cord.

Both of these outfits are being used commercially and not only are adding to the revenue from rural lines but are helping us to show our present and prospective farm customers the characteristics and possibilities of the electric motor for farm power use.

Tieing In Merchandising with National Advertising

THE Empire District Electric Company of Joplin, Mo., has developed a plan to take advantage of the national advertising program and increase the sale of toasters and percolators. About once a week during the March national toaster advertising campaign the two largest wholesale bakers in Joplin will inclose with each loaf of their bread a certificate which will be good for one dollar on the purchase of any toaster at the central station. During the national percolator advertising campaign, from April 15 to May 15, a local coffee-roasting concern will inclose with each pound of coffee a certificate which will be good for one dollar in purchasing a percolator. The toasters and percolators will be sold for $1 down and $1 a month and the new-business department estimates that at least 250 of each appliance will be sold.

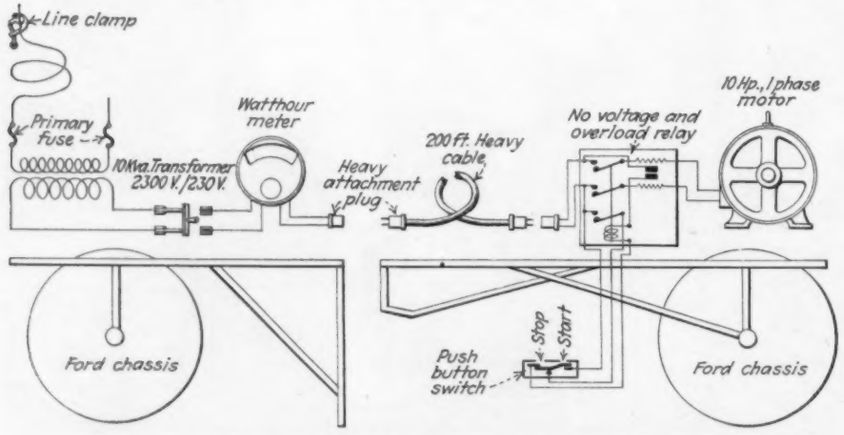


FIG. 3—ELECTRICAL LAYOUT OF POWER TRUCK

Cost of, and Return on, Refrigerator Service

THE El Paso Electric Railway Company, El Paso, Tex., has made an analysis of cost of, and return on, domestic refrigeration service. This analysis has convinced the company of the desirability of this class of load, and perhaps it may incline other central stations that are doubtful of the benefits of refrigeration service more favorably toward it. However, there are probably very few companies in that category and this compilation of costs will be of greater comparative than persuasive application.

DATA ON REFRIGERATORS

Power plant investment, $150 per kilowatt. Average connected load per refrigerator, 100 watts.	
Power plant investment per refrigerator $150 × 0.1	$15.00
Distribution system investment, meters	7.50
Total investment	$22.50
Fixed Charges (Annual):	
Interest .... 8 per cent	
Depreciation. 4	
Taxes, ... 2	
Insurance... .1	
Total.....15, or $22.50 × 15%...	3.38
Annual Operating Expenses: Switchboard costs plus losses and such other items of expense directly incurred as a result of refrigerator business, 1.5c.	
Estimated annual average consumption per refrigerator, 1,000 kw.-hr. at 1.5c.	$15.00
Annual service per refrigerator.....	5.00
	$23.38
Annual income per refrigerator, 1,000 kw.-hr. at 4c. per kw.-hr.	$40.00
Total annual expense per refrigerator	23.38
Annual profit per refrigerator.....	$16.62
Sale price per kw.-hr.....	$0.04
Cost price per kw.-hr.....	.0234
Profit per kw.-hr.....	$0.0166
Minimum charge, $30 per year.	

As the refrigeration peak is in August and the light load is in December, it is believed that domestic electric refrigeration is a very desirable load at the rate given above.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Radiation in Boiler Furnaces.—B. N. BROIDO.—There is now a noticeable tendency toward an extensive application of water-cooled furnace walls for absorbing heat by radiation. The author discusses the relation between the amount of fuel burned, the surface exposed to direct radiation in the furnace and the total heat absorbed by this surface. The influence of the characteristics of the fuel and the manner of burning it is summed up thus: Where coal which has a moisture content not greater than 4 per cent, a volatile content of approximately 20 per cent and an ash content of not more than 7 or 8 per cent is burned in pulverized form, there is no reason why the furnace cannot be completely covered with water-cooled surfaces. For the same coal burned on stokers it would be advisable to have the lower part of the furnace lined with brick in order to accelerate combustion on the stoker. With coal containing moisture up to 10 per cent and ash from 7 to 10 per cent, about 20 to 25 per cent of the surface will have to be of the refractory type unless means are provided for effectively mixing the gases in the furnace. It appears, however, that with coal having 25 per cent of moisture or a very high ash content it is not advisable to have more than two sides of the furnace water-cooled; when it is burned in pulverized form the bottom may also be water-cooled. With preheated air the amount of water-cooled surface can be increased in every plant installation. — *Mechanical Engineering*, February, 1926.

Specifications. — The formulation of general specifications for major items of power-plant equipment is here treated. The aim is to assist the specification writer to produce specifications which will clearly describe the equipment wanted and the performance expected of it under definite conditions. It is recognized that inflexible standards cannot be set up, and no attempt is made to place any limits on equipment characteristics. It is assumed that the specification writer will do this for particular cases. The pamphlet contains specification forms for surface condensers, underfeed stokers, forced-draft fans and superheaters. — *Serial Report of Prime Movers Committee, Technical National Section, N. E. L. A.*, February, 1926.

Goldenberg (Germany) Power Station.—W. KRASKA. — Started in 1914 with an installed capacity of 60,000 kw., this largest European power station was gradually increased to its present-day capacity of 400,000 kw. In this detailed article comprehensive description is given of the main features of this immense plant, which is near Cologne at the mouth of a soft-coal mine and in close proximity to the River Rhine. A total of 600 miles of 110-kv. transmission lines, to which are connected fourteen substations, carries the energy to a large number and a wide variety of power consumers. In four large boiler houses are installed 68 boilers with superheaters and hydraulic ash removal. Each boiler can furnish 30 tons of steam per hour at 15½ atmospheres pressure. In the power house operate six turbo sets of 15,000 kw. and four of 55,000 kw. each, the steam turbines of the latter being single units. Each of the smaller generators feeds a 23,500-kva. transformer; two of the large units are connected to one 60,000-kva. transformer, while the two latest large generators feed two 30,000-kva. transformers each. The station contains two double-bus systems, one for 25,000 volts and a second for 110,000 volts. All transformers and the entire switching system are installed in buildings. During 1925 the plant generated 1,100,000,000 kw.-hr. It is expected to connect the plant with Munich in the near future over a 220-kv. line.—*Elektrotechnische Zeitschrift*, Jan. 21 and 28, 1926.

Generation, Control, Switching and Protection

Switch Defects Due to Sludge.—E. WENKE.—The writer, who is superintendent of a large Bavarian power system, had to contend with frequent faults on oil switches caused by sludging of oil, the deposit starting a creepage path. The generally assumed self-cleaning of porcelain parts under oil because of the agitation of the oil during the movement of the switch contacts does not hold true, because oil sludge sticks very firmly to the smooth porcelain surfaces, even if they are installed vertically. Such a deposit only a few weeks old will reduce the resistance to electric creepage sufficiently to induce an arc-over on the endangered part. Present means do not permit an indication of such internal weakening of oil switches. The author has devised a new method to accomplish this by introducing a small amount of insulation between the switch tank and ground and measuring the current across this insulation. Interposing a contact-making relay, an alarm may be given in case the creepage current exceeds a certain safe value.—*Elektrotechnische Zeitschrift*, Feb. 18, 1926.

Influence of Density Upon Weight and Volume of Air Which Passes Through an Electrical Machine.—C. J. FECHHEIMER.—In an electrical machine the weight of cooling air that enters in a given time is the same as that which is discharged, but the volumes are not equal, because both the pressure and the temperature change during its passage through the machine. The actual velocities in the ducts will therefore also differ from the velocities based on the assumption of the constant density. Further, the fan losses increase the temperature and decrease the density. These relationships are studied analytically, and it is shown by illustrative examples that the final air temperature rise may be in excess of the value computed without regard to the decreased density by as much as 9 or 10 per cent. If the characteristic pressure-volume curve of the fan is known an analytical-graphical solution is possible. — *Electric Journal*, February, 1926.

Transmission, Substations and Distribution

Graphical Representation of Voltage Changes.—J. OSSANNA.—In this paper, fourteen pages in length, the writer develops new mathematical and graphical methods to calculate the change in voltage at a given point in an extended alternating-current distribution network when an additional load is connected at that point. Assuming different variables, operating diagrams are developed for every assumed case, from which can be read the obtaining characteristic values. Diagrams of this nature are of great value for the proper dimensioning of large networks as well as for the visualizing of possible changes at a given point of a distribution system when the connection of a new load is contemplated.—*Elektrotechnik und Maschinenbau*, Feb. 7, 1926.

Study of High-Voltage Bushings.—H. STAUFFER.—For a given degree of electric safety the size and weight, and consequently the cost, of a high-voltage bushing will be governed by the amount of insulating material used in the design of the bushing. If the exact distribution of the electric field is known, it is possible to apportion the dielectric accordingly, and it will then be possible to build the least expensive safe bushing for given conditions. A further factor governing the design is the control of local electric stresses, such as arise near metallic edges or at points where solid dielectric and air concur. In his paper the author shows the theoretical procedure to ascertain field and stress conditions on bushings for high voltages. He points out the most endangered area at the spot where the bushing comes nearest to the metallic collar holding it in the wall or the cover of the apparatus and suggests a method to alleviate greatly the stress in this zone by surrounding the bushing with a ring of oil held in a concentric vessel around the bushing core. —*Revue Générale de l'Electricité*, Jan. 9, 1926.

Units, Measurements and Instruments

Methods of Testing Electrical Apparatus.—This article, one of a series, contains practical suggestions on the setting up and preliminary adjustments of rotating machines, in particular those for direct current. It covers such items as the choice of pulley sizes and belt tensions, polarity tests on the field poles, methods of seasoning commutators, fitting brushes, and discusses at some length the various methods for setting the brushes on the neutral.—*Electric Journal*, February, 1926.

Diversity Factor of Power Consumption.—G. DETTMAR.—According to the author's analytical study, tariffs for sale of electrical energy to customers are frequently faulty and often unjust. In a long paper he makes a very close study of the average diversity factor

of the many classes of power consumers and compares his time-load curves with those of former investigators. Combining these curves with cost curves of the generated energy, he arrives at selling prices per kilowatt-hour which he thinks would be satisfactory to both the producer and the consumer of electric power. By taking full advantage of the alleviation of various load peaks tariffs can be established more adequate than the present methods, which are usually arrived at by more or less inaccurate guesswork.—*Elektrotechnische Zeitschrift*, Jan. 14 and Feb. 18, 1926, and *Der Elektrische Betrieb*, Jan. 24, Feb. 10 and Feb. 24, 1926.

Experimental Loss Measurements on Generators.—E. ROTH.—In this 20-page article the well-known author discusses a problem which was propounded by the International Electrotechnical Commission, suggesting some simple methods to determine by tests the exact losses in electric generators under various conditions, such as under varying load or varying power factor. After expounding theoretical and graphical foundations for loss measurements, the writer gives a large collection of practical data as a result of tests made on three generators rated at 125 kva., 320 kva. and 7,500 kva.—*Revue Générale de l'Electricité*, Feb. 6, 1926.

Illumination

Isocandles. — FRANK BENFORD. — To present the distribution of light about a symmetrical unit it is usually sufficient to plot the distribution curve in one plane through the axis of the unit, according to a well-known method. If corresponding information is to be given regarding an asymmetrical unit, however, a family of such curves would have to be plotted in various planes, from which the actual distribution in space could only be visualized with great difficulty and computations of illumination can rarely be carried out. A different form of presentation is therefore offered. The unit is imagined to be at the center of a large sphere. If the latter is ruled off in meridians and parallels like a globe, the light received at any point can be plotted. If, further, all points illuminated to the same intensity are connected by a smooth curve, like points at the same elevation on a map, there results a series of "isocandle" lines. The difficulty is that a spherical surface is unsuitable for general use, while the representation of such a surface on a plane introduces distortion either of area or of shape. Accepting the latter objection as the less important in photometry, while securing true relative areas, the author makes use of a figure wherein the meridians are plotted as equidistant sine curves, the parallels being kept as horizontal lines. On this surface the isocandle lines are then drawn for the unit in question. In the paper numerous charts are given, showing the distribution for a variety of lighting units. From these charts it is possible by a combination of graphical and tabular computations to find the illumination along a series of lines—for instance, along a street, taking the illumination due to each light source separately and adding the results. This leads, in turn, to isolux curves for the street area under investigation. The discussion of the paper includes a description of a chart developed by Ward Harrison and J. L. Kamm, based on the isocandle chart, which transfers the isocandle curves to the street surface. — *Transactions of I. E. S.*, February, 1926.

Motors and Control

Electric Elevator Practice.—E. M. BOUTON.—In this descriptive paper the author first discusses the common types of passenger elevator drives; that is, the several forms of rope drive and the traction machine. The latter is the one almost universally used today, being simpler, safer, more compact and better adapted to tall buildings than the drum hoist For high-speed elevators in tall buildings the most usual speed is 600 ft. per minute. Very low-speed gearless motors are used for such service, a common speed being 64 r.p.m., which would then be applied to a 36-in. sheave. Such motors do not require commutating poles. Since the elevator is usually counterpoised for 40 per cent load, the motor must be capable of functioning either as a motor or as a generator. The motor is usually designed so that the starting torque is two and one-half times full-load torque, the rating of the motor being given by the relation Hp. $= T \times$ r.p.m. $\div$ 5,250, where T is the rated torque at full load and r.p.m. is the rated speed at load. The article is to be continued.—*Electric Journal*, February, 1926.

Low-Speed Motors.—J. DE BELLAIGUE. Investigating the most suitable type of motor for the drive of air compressors, the author finds that only direct drive is economical, calling for a motor of between 150 r.p.m. and 200 r.p.m. For this requirement only the three-phase synchronous motor was available formerly. The latest developments of the synchronized induction motor have, however, brought this type of motor to a point of such perfection as to make it equally suitable for the purpose, having, in addition, the advantage of simpler starting as compared with synchronous motors.—*Revue Générale de l'Electricité*, Jan. 9, 1926.

Heat Applications and Material Handling

Large Arc Furnace.—P. BERGEON.—An unusually large and uniquely designed furnace has been in operation since 1924 in Saint Julien, France, producing alloy steel. The arc-resistance-type furnace is built with an octagonal cross-section and represents really eight furnaces combined into one, having eight movable upper electrodes and one common bottom electrode. Four transformers, installed under the furnace, each feed two of the eight sections. The total current in the oven varies between 100,000 amp. and 120,000 amp. at an average of 50 volts. A power factor of 0.95 to 0.93 can be maintained. The primaries of the four transformers are in parallel on a 50-cycle, 5,500-volt, single-phase supply. A current consumption of 3,250 kw.-hr. per metric ton of alloy steel is reached in the average run.—*Bulletin de la Société Française des Electriciens*, No. 53, 1926.

Electrophysics, Electrochemistry and Batteries

Wave Analyzer.—R. TH. COE.—The graphical interpretation of an oscillographically obtained wave record to detect higher harmonics is a very tedious and in the end inaccurate procedure. Yet it becomes frequently necessary to establish the presence of high-frequency harmonics because they may be the cause of undesirable interferences between power lines and telephone lines. The author has developed and describes in this paper a portable and highly accurate wave analyzer, which permits the detection and measurement of harmonics up to the forty-ninth with an accuracy within five-hundredths of 1 per cent. The basic principle of the apparatus is the combined action of the investigated current and a purely sinusoidal current upon the coils of an electrodynamometer. — *Revue Générale de l'Electricité*, Feb. 6, 1926.

Origin of the Earth's Electric and Magnetic Phenomena. — W. F. G. SWANN.—In this paper the author analyzes quantitatively some of the theories that have been advanced to account for the earth's magnetic field and atmospheric electric potential gradient. It turns out that exceedingly minute deviations from some of the accepted relationships would readily account for the observed phenomena. Indeed, the fault of some of the theories is that they would give results enormously too great. The author sketches a modification of the laws of electrodynamics which involves the addition of two terms to the current density in the field equations for positive electricity, while leaving those for negative electricity unchanged. These terms amount at most to 10^{-36} and 5×10^{-39} respectively of the main term of the classical theory. The modification provides for the correct value of the earth's magnetic field and its ratio to that of the sun. It postulates a slow death of positive electricity, at the rate of one-half of 1 per cent of the earth's charge in a hundred quintillion years. The surplus of negative electricity provides for the atmospheric current and the potential gradient.—*Journal of Franklin Institute*, February, 1926.

Traction

Safety Device for Electric Locomotives.—A device has been developed and applied to some locomotives in Switzerland which serves a somewhat similar purpose to the "dead man's handle" in cutting off power and applying the brakes, but the action is deferred until the locomotive has covered a predetermined distance. The diagrams and description show that the electrical mechanism is interconnected with the coupling rod in such a way that after the push-button is released a nut is obliged to travel along a screw before the contact is closed that trips the circuit breaker and sets the brakes. Depressing the button before the required distance has been traversed restores the mechanism to its initial position. Instead of a single button on the controller handle, two are provided, the second for use when the operator leans out of the window during switching.—*Electrician (England)*, Jan. 22, 1926.

News of the Industry

Ready for "All Aboard!"

Five Special Trains to Atlantic City N. E. L. A. Meeting, Augmented by Twenty Special Cars

SPECIAL train service arrangements for the convention of the National Electric Light Association to be held at Atlantic City on May 17 to May 21 are now complete. Five special trains will be operated both ways, known respectively as the Western, Central, Southern, Chicago and New England Specials.

The Western Special will be composed of special cars operated on limited trains from Portland, San Francisco, Denver, Omaha, Topeka, St. Paul and Milwaukee, which will be assembled at Chicago and run as a special train to Atlantic City, leaving Chicago (Pennsylvania Station) at 12:50 p.m. (Central time) Saturday, May 15. The return trip will be the reverse of the going trip, leaving New York (Pennsylvania Station) at 1:55 p.m. (Eastern standard time) Tuesday, May 25.

The Southern Special will be composed of special cars operated on limited trains from New Orleans, Montgomery, Atlanta, Nashville, Louisville and Charleston, W. Va., which will be assembled at Washington and run as a special train to Atlantic City, leaving Washington at 8:00 a.m. (Eastern standard time) Sunday, May 16. The return trip will be the reverse of the going trip, leaving New York (Pennsylvania Station) at 5:45 p.m. (Eastern standard time) Tuesday, May 25.

The Central Special will be composed of special cars operated on limited trains from Houston, St. Louis, Indianapolis, Detroit, Toledo and Cleveland, which will be assembled at Pittsburgh and run as a special train at Atlantic City, leaving Pittsburgh at 3:51 a.m. (Eastern standard time) Sunday, May 16. The return trip will be the reverse of the going trip, leaving New York (Pennsylvania Station) at 1:05 p.m. (Eastern standard time) Tuesday, May 25.

The Chicago Special will leave Chicago (Pennsylvania Station) at 1 p.m. (Central time) Sunday, May 16, arriving in Atlantic City at 9:45 a.m. (Eastern standard time) Monday, May 17. On the return trip it will leave Atlantic City at 3:40 p.m. (Eastern standard time) Friday, May 21, and will arrive in Chicago at 10:05 a.m. (Central time) Saturday, May 22.

The New England Special will operate over the New York, New Haven and Hartford Railroad, leaving Boston (South Station) at 10:45 p.m. (Eastern standard time) Sunday, May 16. On the return trip it will leave Atlantic City at 9:30 p.m. (Eastern standard time) Friday, May 21. A special car will be operated from Springfield, Mass., leaving 11:20 p.m. May 16 and arriving back 6:40 a.m. May 22.

The schedules of the Western, Central and Southern Specials have been so arranged as to permit the delegates traveling thereon to spend four days in New York City after the convention before the return trip is made. Robert B. Grove, United Electric Light & Power Company, 130 East Fifteenth Street, New York, is master of transportation.

New Company Incorporated to Own Mammoth Insull Plant

Incorporation papers filed at Indianapolis this week revealed another step in the realization of the enormous plant which the Insull interests of Chicago plan to build to serve their great interconnected system in Illinois and Indiana. This contemplated move was told of in the ELECTRICAL WORLD for March 13 (page 556). The new company, which is to own and operate the plant, will be the State Line Generating Company. The power house is to be built on Lake Michigan, on the Indiana side of the State Line. Its estimated initial cost is put at $25,000,000. As already reported, it is to be designed for an ultimate rating of a million horsepower, exceeding any plant now in existence. The initial installation is expected to be one-fifth of the ultimate.

Not directly related to the plans for the new station, but with a distinct bearing upon them, is the simultaneous announcement by the Commonwealth Edison Company that it has placed an order for 6 miles of 132,000-volt underground cable for installation in its metropolitan territory—a voltage twice as great as the highest now used in underground transmission.

Ghost of Ford Offer Haunts Committee

How Can Muscle Shoals Bids Be Made to Conform to That Variously Interpreted Tender?—Mellon Not Smitten with Government Financing for Boulder Dam

BY PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

APPARENTLY the joint congressional committee on Muscle Shoals is taking very literally the reference in the organic resolution to the Ford offer. It seems to be preparing to do all in its power to help bidders make their offers conform as nearly as possible to that tender. Just how the committee is going to interpret to bidders what the Ford offer was is a matter of speculation. Senators and representatives were alike widely divided on the interpretation of the offer. Many members of each house were convinced that the Ford offer contained no fertilizer obligation. The committee evidently is trying to reach an understanding as to the model which has been set up, as it is maintaining close contact with those who were Ford partisans.

The committee has announced its desire to employ Major-General Lansing H. Beach, retired, the former Chief of Engineers, as a consulting expert. His appointment had not been made effective at the time of this writing, owing to objections in the Senate to an appropriation which would make this expenditure possible. The objection to the retaining of General Beach is not based on any question as to his ability as an engineer. It was he who sent the invitation to Henry Ford which resulted in the first Ford bid for the properties. His testimony before the House committee when the Ford offer was under consideration was favorable to that bid.

The committee is holding daily sessions. Testimony has been taken from a number of government officials, including the Judge Advocate General of the Army, Dr. F. G. Cottrell, the director of the fixed-nitrogen research laboratory of the Department of Agriculture; Major Max Tyler, district engineer at Muscle Shoals; Dr. R. O. E. Davis and Dr. William H. Ross, of the Bureau of Soils. In addition, the committee has heard General Beach and J. W. Worthington. Colonel Worthington spoke on behalf of the American Cyanamide Company.

Formal notification that the joint committee is ready to receive bids was sent to Thomas W. Martin of the Alabama Power Company, E. F. Price of the Union Carbide Company, Henry Ford, W. B. Bell of the American Cyanamide Company, Elon H. Hooker, Frederick T. Hepburn and C. E. Graff of the American Nitrogen Products Company. An actual bid was received from F. E. Castleberry of Shreveport, La. It was stated that he submitted the bid on behalf of clients but declined to reveal who they are. A bid for nitrate plant No. 1 was received from J. H. Levering of Washington, D. C.

An indication of the division which exists in the Senate with regard to the disposition of Muscle Shoals is had in the objections raised to an appropriation for the joint committee. The committee submitted a resolution authorizing it to spend such funds as might be needed in connection with its work. The committee on audit and control restricted any expenditures to a maximum of $10,000. Even that amount brought forth bitter objections and resulted in delaying the authorization.

It is not the purpose of the committee

to make public the bids it will receive. It is recognized that the bidders probably will not name the maximum amount they are willing to give in the first offer submitted. All of the safeguards of the water-power act will be thrown around any lease that is made.

As this is written no concrete evidence has reached Washington that another Ford bid will be forthcoming. The tendency is to believe that no offer will come from that source. The prevailing opinion seems to be that there will be only one offer to which the committee will give serious consideration. That is expected to come from the Union Carbide Company or from that company and the American Cyanamide Company, acting jointly.

Secretary Mellon Opposes Boulder Dam Plan

Efforts to bring the Swing-Johnson bill out from committee have met another setback. The Secretary of the Treasury has entered vigorous opposition to any plan of financing the Boulder Dam project by the sale of United States bonds. The Senate committee had tentatively agreed to report out the bill so as to give Senator Ashurst of Arizona an opportunity to make a point of order against the measure on the ground that it is a revenue bill and should originate in the House. In view of Secretary Mellon's letter, however, the committee probably will not act at this time. There is seemingly no prospect of obtaining favorable action on the part of the House committee.

Secretary Mellon in his letter took occasion to point out some of the weaknesses of public ownership in addition to condemning the proposed financial plan. He denied that proceeds from the sale of government bonds are governmental revenues or that the possibility of future earnings would differentiate the proposed Boulder Dam bonds from other expenditures. The Treasury, he said, would be hampered rather than otherwise by the limitations as to rate of interest and maturity and the partial control over terms given to the Secretary of the Interior. It would be better fiscal policy, the Secretary maintained, to pay for the project out of the general fund or from the proceeds of bonds sold to replenish the general fund and then "earmark the earnings from the project to the payment of interest and principal on an amount of public debt equivalent to that created for this purpose."

Going further and opposing the whole plan of an expenditure by the United States government of $125,000,000 on Boulder Dam, Secretary Mellon declared for private initiative and pointed to the government's experiment in operating railroads and to European and Canadian experiences in justification of his stand. "The fact that a government can furnish capital at lower rates of interest is illusory," he said, "if there be taken into account that the public project pays no tax and therefore does not bear its share of the cost of government. It seems to me that if the project is one which can pay its way, private capital can be found. If it cannot pay its way, then we should consider whether all the taxpayers throughout the United States should be taxed for the benefit of a part of the country." He added, however:

"To these general principles, which I feel to be correct, there may arise exceptions. The Colorado River project involves the adjustment of the interests of seven states and a division of water between the United States and Mexico. In a project which involves a compact between different states and an international agreement it is apparent that action must be had by the federal government if a satisfactory solution is to be obtained. It might be practicable to solve the problem through the federal government and still have the project constructed and operated by private enterprise. Congress may, however, feel that full or partial federal government ownership would be more convenient and under the particular circumstances the present case be made an exception to the general rule of sound policy."

In conclusion, the Secretary offered to have a new bill drafted along lines he could support. He remarked that a fifty-year period of amortization seemed to him "a little long."

White River Power Stands to Win from Ozarks Hydro

Rivalry between the White River Power Company and the Ozarks Hydro-Electric Power Company (whose conflicting applications were received by the Federal Power Commission on Oct. 3, 1925, and Oct. 6, 1925, respectively) for preliminary permits covering projects on the White River and its Buffalo Fork and North Fork in Arkansas and Missouri has brought out a report to the commission from Executive Secretary Merrill, who recommends that the preliminary permit go to the White River Power Company, the Ozarks Hydro-Electric Power Company to have thirty days to contest the recommendation. Mr. Merrill says that no important consideration of priority of application is involved and that both applicants possess satisfactory financial ability, but that the White River Power Company has made the greater progress in investigations completed to date and that its proposed project provides for the more comprehensive development of the resources involved.

The White River Power Company proposes to construct one dam in Buffalo Fork near its mouth, one in North Fork near its mouth and five dams in the White River. The Ozarks Hydro-Electric Power Company proposes to construct one dam in Buffalo Fork near its mouth, one dam in North Fork near its mouth and one in White River. The White River company plans a 142,000-hp. development, although the district engineer thinks that four of its proposed dams (the lower ones) might be eliminated, reducing the total power to 80,000 hp. The Ozarks company's plans are for 58,000 hp. The White River company's probable installed capacity is put at 350,000 hp., the other company's at 150,000 hp. The Ozarks Hydro-Electric Power Company is the successor to the old Dixie Power Company, whose original permit, the cause of much conflict, was allowed to expire despite its extension by Congress.

Oil City Has More Trouble

Power Goes Off Again When River Ice Renews Floods and Emergency Tower Is Overthrown

RENEWED disaster came to Oil City, Pa., and the Citizens' Light & Power Company this week when the unprecedented ice gorge in the Allegheny River again brought flood and destruction. The flood began on Sunday, and the company's West End power plant was flooded by 3.30 p.m., but the connection with the Penn Public Service Company system which had been rushed to completion as described in the ELECTRICAL WORLD for March 20 (page 624) made it possible at first to continue a normal supply of electricity to Oil City, Franklin and Titusville.

On Sunday evening, however, three spans of the Big Rock bridge were carried away by the ice, and a transmission line strung over the bridge went with them. A new line was carried across the river by workmen in the early hours of Monday morning; but at 3 o'clock in the afternoon the steel tower near the West End plant bearing the 1,100-volt supply from the Penn Public Service lines to Oil City and Franklin was sheared off suddenly. Street-car and industrial service both stopped, and when evening fell Oil City was in darkness again.

Fortunately the water began to fall, and by 10 o'clock a temporary connection was again made with the trunk line, equipment being erected on top of a coal pile, the highest peak to be found. There a man sat with a string taking measurements of the river, for a three-foot rise would have put the service out of commission once more.

Both transmission lines to Franklin went down—the one which crossed the Big Rock bridge, which served industrial plants, and the new line, which was carried away with the tower. Some power was available in Franklin, however, from the auxiliary plant of the Citizens' Light & Power Company, and that city was without street lights only for short periods. The water supply of Oil City was not shut off, although it was interrupted several times during the breakdown. Service to Titusville from the Penn Public Service lines was not interrupted.

Final relief came between 6 and 7 o'clock Tuesday evening, when the ice in the Allegheny River and its chief tributary, Oil Creek, moved down the river and all danger of further floods passed. By 8 o'clock the river had dropped 10 ft. at the West End power house. The light and power and railway companies are among the heavy sufferers from the disaster, which wrought no little havoc in Oil City. The companies' loss includes the destruction of the Big Rock bridge, damage to the Reno bridge and considerable damage to equipment and to the power house, as well as the expense incurred in making the temporary connection with the trunk-line system and reduced income because of the curtailed supply of energy. Officials of the electric company could not give out exact figures. They say that local power will not be available for weeks, as it will require time to dry the equipment.

Wisconsin Inspectors Meet

Excellent Session at Madison—Proposal Made to Amalgamate with the International Association

WITH a representation from all parts of Wisconsin that far excelled the attendance at any of its previous gatherings, the fifth biennial convention of the Wisconsin Electrical Inspectors' Association, held in Madison on March 17 and 18, in the City Hall building, was heralded as the most successful yet held in the history of the organization from an educational and instructive standpoint.

Speaking on "Improving Our Agencies for Electrical Standardization," W. J. Canada, electrical field secretary of the National Fire Protection Association, New York City, declared encouraging progress has been made in the movement to standardize electrical installation, in spite of the fact that each community presents an individual and separate problem. He added that electrical standards must be nationally uniform and that methods must be evolved to assure such uniformity, which could be brought about only by more close and effective association of electrical inspectors, state organizations, sectional associations, local groups and national bodies.

A plea for the dissolution of the association and amalgamation with the Wisconsin branch of the International Association of Electrical Inspectors was the keynote of the address on "Unity" by William S. Boyd, Chicago, secretary of the Western Section of the International Association of Electrical Inspectors. He emphasized the fact that manufacturers, contractors engineers and workers are already organized nationally and maintained that the local inspectors' associations must do likewise if they are to combat effectively the present downward trend in electrical standards. No action was taken by the convention on Mr. Boyd's unification proposal, though it is expected strong opposition will manifest itself. The first day's session was concluded by an address by Fred Trayser, regional specialist of the General Electric Company, who broadly described the wiring policies of his company.

SOLVING THE FUSE PROBLEM

The second day opened with a spirited round-table discussion on the "Solution of the Fuse Abuse Problem," which was led by prominent men in each department of the electrical field. R. J. Nickles, Madison, in explaining the contribution of the contractor toward solving this growing problem, lamented the trouble caused by the careless use of fuses. Licensing of electrical contractors and journeymen, with a view to elevating the electrical business to a much higher plane, was urged by Mr. Nickles. The contribution of the electrical engineer to the fuse problem was taken up by Alvin Meyers, assistant professor of electrical engineering, University of Wisconsin, who believed that women much more than men should know something of electricity because of their more frequent contact with electricity and its uses in the home. He advocated instruction to school children so that they may learn the right and wrong way to use appliances and fuses. E. J. Kallevang, chief engineer Wisconsin Power & Light Company, provided the contribution of the central station to the round-table discussion, and Harvey Griem, West Allis, that of the electrical inspector.

A round-table discussion was also held on "The Misuse of Flexible Cord," in which L. W. Burch, Madison, and W. S. Wilder and Joseph Gloyeck, Milwaukee, voiced their opinions from the standpoint of the contractor, the central station and the electrical engineer.

Lewis D. Gettle, chairman of the Wisconsin Railroad Commission, principal speaker at the final afternoon session on Thursday, addressed the inspectors on "Co-ordination of Commission and Municipal Inspection." He emphasized the growing demand for electrical inspectors throughout the state owing to the constantly growing use of electricity in the home, office and factory, and expressed thanks for the excellent support and co-operation the commission has received from the association in the development and application of the electrical code.

Election of new officers was postponed, but should the Boyd annexation plan fail the association will elect officers at one of the district monthly meetings.

Society for Electrical Development Elects Directors

Three directors were added to the board of the Society for Electrical Development, to fill unexpired terms and vacancies, when the society held its annual meeting in New York on March 19. These new directors are George L. Patterson, president of Stanley & Patterson of New York, and Frank S. Price, president of the Pettingell-Andrews Company of Boston, both representing electrical jobbers, and C. M. Beltzhoover, president of the Beltzhoover Electric Company of Cincinnati, representing contractor-dealers. J. E. Montague of Niagara Falls, representing central-station companies; Herman Plaut, manufacturers; W. I. Bickford, jobbers, and C. L. Chamblin, contractor-dealers, were re-elected. The following directors were reappointed for one year: Herbert A. Wagner, H. B. Crouse, L. P. Sawyer, N. G. Harvey, W. H. Morton, J. Robert Crouse, Henry L. Doherty, James H. McGraw, E. W. Rockafellow and C. A. Ward.

W. W. Freeman, president of the society since 1919, was re-elected for another year by the directors when they met on the following day. W. I. Bickford was added to the list of vice-presidents, who are now, in the order of their seniority, J. Robert Crouse, J. G. Barry, J. R. Strong, J. E. Montague and W. I. Bickford. The executive committee for the forthcoming year is made up of Charles L. Edgar (chairman), E. W. Rockefellow (vice-chairman), J. G. Barry, S. L. Nicholson, G. E. Cullinan and J. R. Strong. The addition of Mr. Cullinan was in compliance with the by-laws, which have been changed to require six members on the executive committee instead of five.

The following officers of the society were reappointed by the directors: W. L. Goodwin and F. M. Feiker, operating vice-presidents; J. Smieton, Jr., secretary-treasurer. G. E. Jaquet was made assistant secretary and E. A. Beer assistant treasurer.

A number of important matters were brought up for consideration, including presentation of the financial statement, reports of current activities and accomplishments, an outline of the plans under way for amplifying the society's services and a statement of the plans that have been effected for the conduct of Camp Co-operation VI, the fifth conference of electrical leagues.

Southern Rural Electrification Conference Program

The program for the rural electrification conference to be held in Montgomery, Ala., April 6 and 7 and in Birmingham April 8, as announced in the ELECTRICAL WORLD for Feb. 20, is about complete. This conference is being sponsored by the national, Alabama and Virginia committees on the relation of electricity to agriculture and is the first sectional meeting of its kind ever held. The conference will be opened by a welcoming address from Gov. W. W. Brandon of Alabama, which will be answered by Dr. E. A. White, director of the National Committee on the Relation of Electricity to Agriculture, who will speak on the subject "What's Going on in the South." The following addresses and papers will be given during the first two days in Montgomery:

"Progress of Rural Electrification in Alabama," by E. C. Easter, Alabama Polytechnic Institute.

"Rural Electrification from the Farmer's Standpoint," by S. P. Storrs, Farmer.

"The Place of the Farmer in Rural Electric Development," by E. A. O'Neal, president Alabama Farm Bureau Federation.

"The Public Utility in Rural Electric Service," by T. W. Martin, president Alabama Power Company.

"Removing Drudgery from the Country Home," by Miss A. E. Harris, director of home economics, Alabama Polytechnic Institute.

"Rural Electrification in South Carolina," by H. W. Barre, chairman of the South Carolina Committee on the Relation of Electricity to Agriculture.

"Fundamentals of Rural Rates and Contracts," by F. D. Paine, assistant director of the national committee.

"The Agricultural College and Rural Electrification," by M. L. Funchess, dean of College of Agriculture, Alabama Polytechnic Institute.

"Rural Line Construction," by G. H. Middlemiss, Alabama Power Company.

"Research Work at Alabama Polytechnic Institute," by M. L. Nichols, head of the department of agricultural engineering, Alabama Polytechnic Institute.

"Rural Electric Developments in Virginia," by C. E. Seitz, chairman of the Virginia committee.

At a banquet in Montgomery Wednesday night A. G. Patterson, president Alabama Public Service Commission, and in addition either a railroad or a utility executive will give addresses. At a second banquet in Birmingham on Thursday night addresses will be given by W. C. Lassiter, editor of the *Progressive Farmer;* W. E. Henley, president of the Birmingham Trust and Savings Bank, and Robert Jemison, Jr., president of the National Realtors' Association.

Wednesday afternoon and Thursday will be devoted to inspection trips covering electrified farms and dairies and hydro-electric and industrial plants.

Purchases and Mergers

Barstow System Adds Two Pennsylvania Companies—Oswego Merger Goes Through—Other Transfers

PURCHASE of the Boyertown (Pa.) Electric Company and the Annville & Palmyra Electric Light Company by the General Gas & Electric Corporation this week added two electric properties to the last-named company's Pennsylvania-New Jersey interconnected system. The Annville & Palmyra Company serves Annville, Palmyra, Fairland, Cleona, Sunnyside and adjacent territory in Lebanon County, Pa. Both companies formerly operated small generating stations, but now buy power from the Metropolitan Edison Company, which is the General Gas & Electric Corporation's largest subsidiary and main operating company in Pennsylvania.

Negotiations are in progress for the acquisition of common-stock control of the Savannah (Ga.) Electric & Power Company and the El Paso (Tex.) Electric Company by the Engineers' Public Service Company of New York City. Common-stock control of the Eastern Texas Electric Company and the Key West Electric Company has already been secured by the Engineers' company. All these are under the management of Stone & Webster, Inc.

The New York Public Service Commission has given formal approval to the purchase of the capital stock of the People's Gas & Electric Company of Oswego by the Oswego River Power Corporation. Floyd L. Carlisle of the purchasing company testified that $125 a share was paid for 19,568 shares of common stock of $50 par value and that $55 a share was paid for 8,989 shares of preferred stock of $50 par value. The book value of the common stock of the People's company, as of Dec. 31, 1925, the commission found, was about $62.22 per share and of the preferred $50 per share, and the order directed the Oswego River Power Corporation not to set upon its books a value greater than the sum of the People's company's capital stock and surplus. Mr. Carlisle said that in 1925 the People's company sold about 7,000,000 kw.-hr. of electricity, whereas a city the size of Oswego ought to buy 20,000,000 kw.-hr. Power resources will be greatly increased by extending the line of the Northern New York Utilities, Inc., to Oswego.

The Island Power Company of New York is asking for permission to buy the Patchogue Electric Light Company. The Island Power Company was recently organized and is authorized to issue 6,000 shares of no-par-value stock. It is proposed to exchange this stock share for share for the stock of the Patchogue company, of which there are 6,000 shares outstanding.

Troy, Graham & Company, Chicago bankers, have organized the Colorado Utilities Corporation to purchase the electric plants at Craig, Hayden, Oak Creek and Steamboat Springs in northwestern Colorado. A 30,000-kw. generating plant will be built at Mount Harris, the biggest coal center of the region, to replace the individual steam generating units. The preliminary investment is understood to be about $500,000.

The Southern Wisconsin Power Company will exercise an option on the Friendship (Wis.) Electric Light & Power Company, which also furnishes light and power service to Adams from its two water-power plants.

The Lake Superior District Power Company has bought the Athens (Wis.) Electric Light & Power Company, which has a small steam plant.

Three more municipally owned electric systems passed out of existence in Wisconsin when the Railroad Commission authorized the towns of Middleton, Blanchardville and Rib Lake to dispose of their plants to private companies at an aggregate price of $86,000. The Wisconsin Power & Light Company purchased the Middleton plant at a price of $60,000, which includes a transmission line extending from Dane to Middleton, and the distribution system at Blanchardville for $16,000. In the northern part of the state the Lake Superior District Power Company purchased the Rib Lake municipal system for $10,000. Besides these transfers, Fox Lake, Wis., has sold its street-lighting system to the Wisconsin Power & Light Company.

Specialized A. I. E. E. Meeting at Cleveland

Technical and Commercial Aspects of Refrigeration Analyzed—Engineers as Builders of Humanity—Paper Makers Favor Electric Drive

SECTIONAL drive in paper mills, electric refrigeration and the engineer's relation and responsibility to humanity were the three major topics of discussion at the regional meeting of the Middle Eastern District of the A.I.E.E. in Cleveland on March 18-19, which was briefly reported last week. The large registration of 438 was evidence that those in charge had been successful in bringing together in a common interest not only the engineers of the electrical manufacturing and utility companies but also the executives and engineers of industrial plants.

Discussion of the papers noted last week on sectional electric drive brought out the fact that speed regulation as close as one-fifteenth of 1 per cent is desirable, if not necessary, for the best results. Speed control on the couch machine with one type of installation is maintained easily with a field variation of about 0.5 amp. It was suggested that perhaps engineers are going to unnecessary refinement in speed regulation. E. F. Bearce, Chillicothe Paper Company, however, pointed out that in the manufacture of news print sectional electric drive has made it possible for paper makers to increase the speed of their machines from 600 ft. or 700 ft. per minute to 1,200 ft. or 1,400 ft.

Tom Harvey of Gardner & Harvey, Middletown, Ohio, raised the question of how far a paper company could afford to go in increasing its investment to install sectional electric drive in place of existing steam equipment. It was pointed out that where the steam drive had not been installed very long the change to electric drive might superimpose excessive fixed charges, but on any new installation it is always possible to justify the cost of sectional drive over all others. Maintenance costs on this type of equipment have been very low.

BAKER SPEAKS AT DINNER

Newton D. Baker, former Secretary of War, addressed the members on industrial adjustment at the regional dinner on Thursday evening. What the world needs, Mr. Baker declared, is not so many new inventions but the adequate development of what it has. He pointed out that the present-day craze for the latest model or style has led to the discarding of useful and valuable equipment, involving a vast economic waste. He praised the action of industrial companies that have filed away minor improvements to be used when they are ready to change the whole design of their equipment. Mr. Baker also urged engineers to consider all the social aspects attending each new invention.

At the Friday afternoon meeting Farley Osgood, former president of the Institute, denied the implication that engineers are prone to devote too great attention to slight improvements. It is only by means of such developments, he said, that the world has moved ahead. Industrial efficiency, he said, depends to a great extent upon its use of mechanical power in proportion to its man power. America now has four times as much power available per man as any other country, and when proper interconnection of electric power lines in the United States is made, fifty million additional man power will be released for more gainful and productive work. Mr. Osgood also urged upon technical educators the need for more diversified studies in engineering institutions and a better working knowledge of the English language. He suggested that student engineers should also be taught at least the fundamental principles of law, finance, business practice and marketing.

Charles F. Kettering, president General Motors Research Corporation, presented a highly interesting and instructive address and demonstration on Friday on a number of the scientific phases of refrigeration. In reviewing briefly the development of mechanical refrigeration he undertook to clear up certain popular notions that are not technically correct and emphasized the fact that refrigeration must be considered as a matter of relative temperature in which the problem is one of heat control. Mr. Kettering predicted that the next step in domestic refrigeration would be the cooling of houses in the summer time and believed that with proper heat installation this can be accomplished in a six-room house with a machine operated by a 5-hp. motor.

The effect of the domestic refrigeration load upon the incomes of central-station companies was analyzed by

G. E. Miller, sales manager of the Cleveland Electric Illuminating Company. This device offers one of the best opportunities for improving the load factor of and increasing the revenue from the residential customer. Mr. Miller drew a picture of the possibilities of this business on a national basis, saying that this load by 1929 should add $35,000,000 annually to the central-station companies' gross revenue. With further price reductions it should be possible to sell refrigerators to 25 per cent of the residential customers, which would bring a gross annual revenue of $87,500,000. Domestic refrigeration returns a higher rate of income per kilowatt of demand than any other load and is the best class of business that an electric utility company can attach to its lines, Mr. Miller declared. Diversity of use after a number have been installed is very high, and from the characteristics of the load a daily load factor of virtually 100 per cent is produced. Seasonal demand is also high, the maximum coming during the summer when the lighting demand is at its minimum.

Scott and Knapp Tell Industrial Men of Electrical Heat

The electrical industry is deriving an income of $97,895,000 from electric heat machines at the present time, asserted Wirt S. Scott of the Westinghouse Electric & Manufacturing Company at the industrial heating conference held at Purdue University, Lafayette, Ind., last week. More than two hundred electrical men attended the session. Mr. Scott said that the electrical industry, with its present facilities, is capable of developing power for industrial heat which will bring more than two billion dollars in annual revenue. L. K. Knapp of the General Electric Company told of the progress of the electrical heating industry since 1917. Both speakers declared that the use of electricity for heating purposes has a bright future and asserted that some industrial companies are planning to use this process exclusively as soon as power can be provided.

Six of the latest types of electric furnaces were set up in the new electrical engineering building at the university and were used for demonstration purposes at the conference.

Electric Refrigeration Topic at A. S. R. E. Meeting

Domestic electric refrigeration was the subject discussed at a meeting of the New York Section of the American Society of Refrigerating Engineers on the evening of March 17 at the Machinery Club, New York. Interest in the subject was attested by one of the best-attended meetings the society has ever held. Hamilton G. Scott, chairman of the board of directors of the Servel Corporation, spoke on the reason for the formation of the Electric Refrigerating Council and the educational task which it has begun in cooperation with the Society for Electrical Development. He pointed out that this educational work would bring benefits which would not only accrue to the manufacturers who were members of the council but to all refrigerator manufacturers and all central-station companies as well as to the ice manufacturers, since it would also lead to an extended use of ice and to an appreciation of the real principles of refrigeration. Mrs. Julian Heath, president of the National Housewives' League, spoke on the great need for the education of the housewife and pointed out that electric refrigeration must be sold to the housewife in two steps, first by teaching the value of refrigeration before taking the broad step to electric refrigeration. Mrs. Heath spoke on the necessity for further reducing the cost of electric refrigeration and stressed the value of a practical appeal to the housewife in her own language.

Officers of Illinois State Electric Association

The twenty-fifth annual convention of the Illinois State Electric Association, held in Springfield March 17 and 18, as reported last week, was the largest and most successful in the history of the association, according to veteran utility men who attended. It is expected that the 1927 convention also will be held in Springfield.

Officers were elected as follows: President—John H. Mitchell, general manager East St. Louis Light & Power Company, East St. Louis; vice-president—Julius L. Hecht, vice-president Public Service Company of Northern Illinois, Chicago; secretary-treasurer (re-elected), Robert V. Prather, Springfield. The executive committee will contain B. J. Denman, Moline; R. W. Wallace, Peoria, and J. Paul Clayton, Springfield.

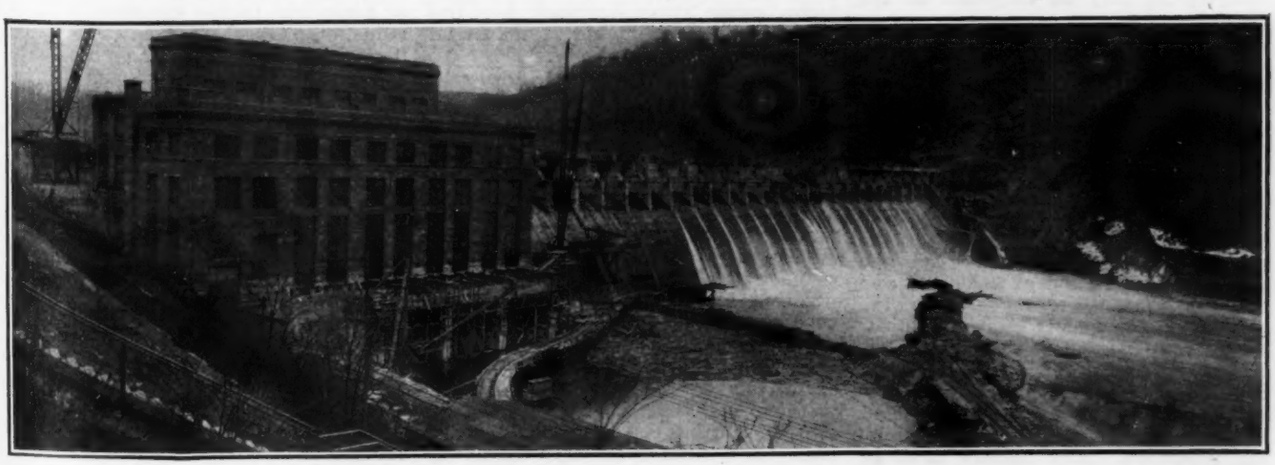
Projects Before Federal Power Commission

The Fitkin Utilities, Inc., of New York have applied to the Federal Power Commission for a preliminary permit covering a project on the Santa Fe River in Columbia County, Fla. It is proposed to create a reservoir area of 4,519 acres. The power is to be sold to the Florida Power Corporation.

M. L. Requa of San Francisco has applied for a preliminary permit covering a project in the Tongass National Forest in Alaska, at a point 50 miles northwest of Juneau. The power is to be used for paper and electrochemical plants.

The Great Northern Railway Company has applied for a license to cover

Cheat Haven Dam in Western Pennsylvania Now Almost Completed



WITH an initial capacity of 64,000 kw., in four units, and an ultimate rating of half a million horsepower, the coming into operation next fall of the Cheat Haven hydro-electrc plant of the West Virginia Power & Transmission Company will be an important event in the history of the West Penn system, of which the plant will form a part. Work on this plant is six months ahead of schedule, and the concrete dam, 1,110 ft. long and 110 ft. high, is now virtually complete, water having flowed over it in the last days of December. The photograph was taken three or four weeks ago. The power house is also about ready, and the machinery is being delivered.

The development at Cheat Haven was designed and is being constructed by Sanderson & Porter of New York in collaboration with Mead & Scheidenhelm, consulting engineers, and the executive officers and engineers of the West Penn system. William E. Hamilton is manager of construction in charge of the work.

the construction of a transmission line in King County, Wash.

A license has been issued to the Montana Power Company covering a transmission line 93 miles long, known as the Billings-Hardin-Colstrit line.

The preliminary permit granted the Northwestern Power & Manufacturing Company for a project on the Elwha River, issued Nov. 10, 1924, expired Feb. 13.

The Cumberland Hydro-Electric Power Company of Indianapolis, a subsidiary of the Middle West Utilities Company, has applied to the commission for a license covering its project on the Cumberland River near Burnside, Ky. The dam is to be 80 ft. in height and will be erected at a point 3,500 ft. above Cumberland Falls. The power house will be erected 4,800 ft. below the falls. It is planned to install equipment necessary to develop 40,000 hp.

Development on the Ottawa

The first annual report of the Ottawa River Power Company of Ottawa, Canada, shows that the company's plant on the Ottawa River near Byrson, 50 miles above the city of Ottawa, was placed in operation last May and since that time has been delivering power to its customers and the Ottawa & Hull Power Company, Ltd. There is at present one unit of 22,500 hp. capacity installed. The ultimate installation of three units will bring the rating of the plant up to 67,500 hp.

The construction program of the International Paper Company in the vicinity of Ottawa calls for two hydro-electric plants, one at Chelsea, about 9 miles north of Ottawa, on the Gatineau River, and one at Farmers Rapids, just below Chelsea. These two plants will have an initial installed capacity of 200,000 hp., with provision for a larger ultimate capacity. They will not only supply the power required to operate the company's new mill at West Templeton, on the Ottawa River, but will also be a source of supply for such industries as may be attracted to the district.

Supervisors Set Valuation on Hetch Hetchy Plant

By a vote of thirteen to two the Board of Supervisors of San Francisco has adopted an ordinance placing a valuation on the Moccasin plant of the Hetch Hetchy municipal project and providing for the distribution of the power revenue. The ordinance sets the valuation of the plant at $9,000,000 and provides that the revenue from the plant's power, which is being sold under contract to the Pacific Gas & Electric Company for $2,000,000 a year, shall be used for repairs, reconstruction, operating expenses of the power plant and bond interest and redemption on the $9,000,000. Any balance shall be used for the construction of a transmission line from Newark to San Francisco and of the stepdown station at Newark.

Opposition to the adoption of the measure was based on the fact that M. M. O'Shaughnessy, city engineer, had placed a valuation of $21,000,000 on the Moccasin plant and that setting it at a figure so much lower would establish a bad precedent, as that would be the amount on which other communities would base rate demands should they wish to buy power from San Francisco. The proposed transmission line was also opposed on the ground that its construction now would be premature and might, if the people vote against a municipal distribution system, prove a waste of money.

Wagner Testifies Before Maryland Commission

Hearings are now proceeding before the Maryland Public Service Commission to determine whether the Consolidated Gas, Electric Light & Power Company shall be ordered to reduce its rates below the voluntary cut announced by the company a few months ago. The company puts the estimated saving by this reduction at about $875,000 annually. People's Counsel C. W. Miles contends that a further reduction of $500,000 or more should be made. The company does not ask to have its valuation increased.

Interest was manifested in the company's contract with the Pennsylvania Water & Power Company, from whose Holtwood plant the Baltimore company purchases much energy. Herbert A. Wagner, president of the Consolidated, testified that the new steam generating plant at Holtwood would release all the power to the Baltimore company which the latter could take. This requirement is estimated to be 366,000,000 kw.-hr. a year.

Holtwood power has been purchased for 6 mills a kilowatt-hour. In Baltimore power is generated in the company's plant for 4.9 mills, Mr. Wagner said. During the last fifteen years the company has had a contract for the purchase of power from Holtwood for 6 mills. At the present time a ten-year contract on the same price basis is under consideration. The witness said that steam generation equipment in Baltimore gradually would make hydro power from Holtwood less important in the supplying of industrial power in the Maryland city.

Mr. Wagner defended the expenditure of $60,000 a year on his company's radio broadcasting station on the ground that Baltimore was thereby advertised and good public relations promoted. He said an issue of $2,000,000 additional preferred stock had been determined upon, necessitating funds for dividends. He figured the yield on the common stock at a little more than 7 per cent and told of coming expenditures on power plant to take care of the expanding load. Mr. Wagner justified the application of the recent reduction exclusively to the secondary rate by pointing out that although Baltimore consumers using less than 25 kw.-hr. of power in a month pay more than they would under lower primary rates in other cities, the average domestic consumption of 35.7 kw.-hr. costs less because Baltimore's secondary rate has been lowered. In January 110,000 customers benefited from the reduction and 42,000 customers did not. The latter had monthly bills of less than $2.

Briefer News

Reading Buys Boston Edison Service.—The Municipal Light Commissioners of Reading, Mass., have closed negotiations with the Edison Electric Illuminating Company of Boston for the supply of electric service under the Edison company's "co-operative wholesale high-tension rate." Service is to be furnished, if necessary, by the town plant to the extent of its present capacity during peak periods. Two 5,000-kv. underground lines will be extended from Stoneham to the Reading station, where substation equipment will be installed.

Reduction in Lighting Rates Likely in Nashville.—Alleging that the Nashville Railway & Light Company is earning more than 8½ per cent instead of the 7½ per cent permitted, the Tennessee Railroad and Public Utilities Commission has ordered the company to show cause why its lighting rates should not be reduced. Nashville has a top rate of 10 cents per kilowatt-hour, while in Memphis, Chattanooga and Knoxville top rates range around 8 cents, the commission explains.

Plan for Rural Service in Maine Put Forth.—The Maine members of the New England Council have approved the outline of a plan which agricultural leaders have devised with a view to encouraging extension of electric light and power lines in the rural communities of that state. It is proposed to petition the next Legislature to authorize exemption of taxes on electric extensions in rural sections and to permit electric companies to sell certificates of small denominations, bearing 4 to 5 per cent interest, to be issued to cover the cost of such extensions.

Wisconsin Farmers Make Own Investigation of Rates and Are Content.—Instead of following the usual practice of appealing to the commission for a reduction in rural electric rates without first determining whether or not one is justified, the Winnebago County Board of Supervision appointed a special committee of three farmers to learn whether the rates of the Wisconsin Power & Light Company were too high. Statistics from the commission and a neighboring power company were thoroughly studied. The report recommended that no appeal be made for a reduction until the use of electricity on the farms is substantially increased.

Electricity in Mines.—At the annual convention of the Rocky Mountain Coal Mining Institute held in Denver last month Daniel Harrington of Salt Lake City, a consulting engineer and former supervisor of coal mines of the United States Bureau of Mines, in a paper on "Electrical Hazards," said that in seventeen years he had investigated twenty-one mine explosions due to electricity. These resulted in the loss of 300 lives and a great sum of money. The accidents, however, were due, not to improper installations, but to inexperienced and careless men, and the

avoidance of such casualties must be sought in intelligent and rigorous training and supervision.

Seek to Dam Des Moines River.—The Des Moines Electric Light Company is seeking Congressional authority to build a dam 400 ft. long across the Des Moines River below the company's new power plant, at a cost of $500,000, to provide cooling and storage water. The bill has passed the Senate.

Rocky Mount, N. C., Has New Municipal Plant.—A new municipal plant costing $430,000 has just gone into service at Rocky Mount, N. C., after a formal ceremony. The plant, declared to be the largest and most modern of its kind in eastern North Carolina, had been under construction for nearly two years and is rated at 2,500 kw., with a load capacity of 3,300 kw. The old plant, which adjoins the new structure, gives a reserve of 1,800 kw. A reduced scale of power charges, based on the lower production cost of the new plant, has gone into effect.

Puget Sound Company's 1926 Program.—A budget totaling $4,000,000 has been adopted for 1926 by the Puget Sound Power & Light Company. This includes a new service building and an interurban and stage depot. Important electrical items cover equipment to increase the output of electricity from the first unit of the Baker River hydro-electric plant from 40,000 hp. to 50,000 hp. and expenditure of $1,708,000 on extensions and improvements to service and for the completion of the cable connection between the mainland transmission system and the Olympic Peninsula. The company's total power resources will be brought up to about 260,000 hp. Last year the company built 393 miles of rural extensions. This year a record of 500 miles is aimed at.

Cordele, Ga., Contemplates Building a County Plant.—Plans are being completed at Cordele, Ga., by the directors of the board of trade for the construction of a 14,000-hp. hydro-electric plant on the Flint River, 8 miles west of the city, for which the Federal Power Commission has issued a preliminary permit. The plant, which would serve all Crisp County, must receive state approval at the coming elections, and citizens of the county must vote a bond issue of $1,250,000. Much doubt is thrown on the success of the project by those familiar with similar developments, and if it is undertaken, it will be watched all over the state as affording a test of municipal versus private electrical enterprise. Cordele is now served by the South Georgia Public Service Company of Albany, Ga.

Tragic Public Relations at Lhasa.—Under the heading "Lhasa, Thibet, Wakes Up," the ELECTRICAL WORLD on Sept. 20, 1924, took from the London *Electrical Times* an account of the coming installation of the first electric plant in the sacred city of Lhasa, in the Himalayan Mountains. This little Armstrong-Whitworth hydro-electric outfit was to have been installed entirely by native engineers and workmen after being carried up the 11,800-ft. elevation on muleback. Unfortunately, before the enterprise was carried through a reactionary government succeeded the Dalai Lama who had sent a young Thibetan progressive named Ringang to England to procure and transport the plant, and now, if newspaper dispatches from Calcutta are to be believed, the shattered machinery lies with the bones of Ringang, his muleteers and his mules at the foot of a steep peak, where they were hurled by the emissaries of the rulers. After all, Lhasa had only stirred in her sleep.

Inventor of Inside Lamp Frosting Gets Coffin Award.—As a result of Marvin Pipkin's experimental and scientific work in the lamp development department of the General Electric Company, at Nela Park, Cleveland, he has recently received a Charles A. Coffin award in recognition of service in the development of better illumination. Mr.

Pipkin, who is a graduate in chemical engineering from Alabama Polytechnical Institute, became connected with the company's research laboratories after the war. In January, 1924, Mr. Pipkin displayed a bulb which was frosted on the inside and, unlike all previous attempts, was quite as strong as though it had been frosted on the outside, thus accomplishing a task long essayed but theretofore without success. As a result of his achievement lamps are being made with an inside frosting which reduces glare and also gives more light than outside frosting. These lamps have a pearl-gray appearance and take on the color of any background.

Potomac Electric Power Company to Fight Government.—Flatly refusing to follow a ruling by Controller General McCarl, the Potomac Electric Power Company has served notice that it will fight his decision, which holds that refunds from the company's impounded funds are due the United States government for a period of seven years, instead of for two years as contended by the company. The Controller General holds that the government is in the same position as private customers of the company, who are receiving a seven-year refund. The company takes the position that, because of special rates accorded it, the government did not begin to contribute to the impounding fund until July 1, 1922, whereas the public had been contributing since Aug. 1, 1917.

New Englanders to Study Elementary and Advanced Metering.—Courses for metermen will be conducted April 5 to 7 at the Sheffield Scientific School, Yale University, New Haven, with the co-operation of the meter committee, New England Division, N. E. L. A. These courses will differ from the ordinary by their division into elementary and advance instruction. Prof. A. E. Knowlton is in charge of registration.

Bureau of Standards Equipping High-Voltage Laboratory.—The Electrical Division of the United States Bureau of Standards reports that good progress is being made on the installation of equipment in the high-voltage laboratory, which is in the course of reconstruction. Equipment will be provided for measuring the properties of insulating materials. An electrometer will be used principally for testing transformers used in measuring electrical energy at high voltage. After the reconstruction the Bureau of Standards will, it is announced, be able to conduct tests in high voltage with greater accuracy than any other laboratory in the world. Hitherto it has been restricted first to 30,000 volts and later to 100,000 volts. With the new electrometer it will be able to measure with a greater accuracy energy up to 300,000 volts.

Model American Electrical Home to Become an Institution of Welcome in France.—A communication from Maxime Mongendre to Arthur Williams, vice-president New York Edison Company, announces that the American electric home donated to France by American industries and recently on display at the International Exhibition in Paris has been awarded to La Bienvenue Française, of which Marshal Foch is presiding officer and which officially welcomes distinguished representatives of the arts and sciences, industry and public affairs who go to France from all parts of the world. This home, valued at approximately one million francs, was the first fully equipped house to be sent across the Atlantic Ocean. The award was made by a special committee of citizens and officials.

Supplying Energy to the Hudson River Vehicular Tunnel.—Completion of the Holland Tunnel, now being built to enable vehicles to pass under the Hudson River between New York and New Jersey, is scheduled for 1927. This tunnel will consist of two tubes, the north one for traffic from New York to New Jersey, the south one for traffic in the opposite direction. The tubes will be 9,250 ft. long and will cost $42,000,000. The electricity necessary for light, power and ventilation will be supplied by the United Electric Light & Power Company of New York City and the Public Service Electric & Gas Company of New Jersey on a fifty-fifty basis. The former company is arranging to supply the tunnel through three separate feeders, one from the Sherman Creek generating station, one from the Forty-fifth Street substation and one from the Elizabeth Street substation, and each of these feeders will be of sufficient capacity to carry the entire load. The total energy demand requirements in the tubes for ventilation, light

and power are estimated at 2,200 kw. maximum demand and 12,000,000 kw.-hr. yearly consumption. Lamps of 100 watts each will be used.

Rural Service for Georgia.—That the carrying of electric power to the farms of the state will be the next important step taken by the Georgia Railway & Power Company was indicated by H. M. Atkinson, chairman of the board of directors, in a recent address. "We desire," said Mr. Atkinson, "to take part in making electric service universal throughout Georgia and hope soon that it can be made available for all the farms of the state. Electricity on the farms will turn agriculture from a losing business to a profitable pursuit as it has done in industry. It will decrease power and labor costs. It will increase output. It will call for trained minds on the farm and will interest the young men of the state in agriculture. It will mean the decentralization of industry into small communities. Farming will be literally rescued by water power."

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

Arkansas Utilities Association—Hotel Marion, Little Rock, March 29-30. R. I. Brown, Arkansas Central Power Co., Little Rock.

Middle West Division (and Iowa Section), N. E. L. A.—Fort Des Moines Hotel, Des Moines, April 7-9. H. M. Davis, Fraternity Bldg., Lincoln, Neb.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

International Electrotechnical Commission—Engineering Societies Bldg., New York, April 13-22.

American Welding Society—New York, April 21-23. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Chicago Beach Hotel, Chicago, April 22-24. C. G. Fink, Columbia University, New York.

Southeastern Water and Light Association—Hotel Casa Marina, Jacksonville Beach, Fla., April 27-29. W. F. Stieglitz, Columbia, S. C.

Southeastern Division, N. E. L. A.—Pinehurst, N. C., April 27-29. C. M. Kilian, 317 Hurt Bldg., Atlanta.

Nebraska Section, N. E. L. A.—Lincoln, April 29-30. H. M. Davis, Fraternity Bldg., Lincoln.

Missouri Association of Public Utilities—Springfield, Mo., May 2-4. F. D. Beardslee, 315 North 12th St., St. Louis.

American Institute of Electrical Engineers—Regional meetings: Madison, Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

Electrical Manufacturers' Club—Hot Springs, Va., May 12-15. W. F. Field, Safety Cable Co., New York.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association—New York, May 20-21. F. P. Vose, 1008 Marquette Bldg., Chicago.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

Men of the Industry

L. C. Bell, formerly chief engineer of the Illinois Power & Light Corporation at Duquoin, Ill., has been transferred to the company's plant at Venice, Ill., and **J. J. Parrish** of Collinsville has been selected to fill the vacancy at Duquoin.

Roy Samson, formerly of Burlington, Wash., has been transferred to Bellingham, where he has been made superintendent of line construction for the Puget Sound Power & Light Company.

R. P. Tracy, formerly vice-president of Manning, Bowman & Company, Meriden, Conn., has recently been elected president of that organization. Mr. Tracy is also a member of the board of directors.

F. W. Mumby, Jr., of Dalhart, Tex., has been elected vice-president and general manager of the Valdosta Lighting Company and its affiliated companies. These properties were acquired last year by the Fitkin interests.

Harvey Wienschenk has been appointed superintendent of the municipal electric light and power plant of Bellevue, Iowa, in succession to **Joseph Wuerth,** who resigned to accept a similar position in Minnesota.

Charles J. Griffith, vice-president and general manager of the Arkansas Central Power Company, has been made chairman of the Southern Division of the American Mining Congress, which recently met in Memphis. This division is doing much to further the industrial and commercial development of the South.

G. W. Steinke, who has been connected with the Wisconsin Power & Light Company as manager of its electric properties at Omro, has been promoted to be assistant district manager with headquarters at Ripon. Mr. Steinke will be succeeded at Omro by **W. A. Folzman,** formerly with the company at Ripon.

William S. Johnston, formerly with Ford, Bacon & Davis, Inc., is now with Stevens & Wood, Inc., New York City. While with Ford, Bacon & Davis Mr. Johnston was mechanical designer of the Sterlington power station of the Louisiana Power Company and placed the station in commercial service. He returned from Louisiana the first of the month.

Harrison A. Smith, formerly president of the Southern Counties Power Company, Belleville, Wis., recently acquired by the Wisconsin Power & Light Company, has been selected to take charge as manager of the industrial development department which the Wisconsin Power & Light Company has just organized. This new department will engage in furthering the development of the industrial centers which it serves in Wisconsin.

G. W. Carlson has been appointed superintendent of the Keokuk (Iowa) Electric Company, which was taken over last December by the Union Electric Light & Power Company. Mr. Carlson's early experience was with the General Electric Company, but in 1913 he transferred his interests to the Keokuk property. Following a period of military service he returned to the Keokuk company in 1919 as superintendent of the electric department, retaining this position until his recent promotion.

Charles M. Allen, professor of hydraulic engineering, Worcester Polytechnic Institute, and widely known in hydro-electric circles as the originator of the salt-velocity method of testing turbine efficiency, has been elected president of the Boston Society of Civil Engineers.

M. F. Millikan and N. M. Argabrite, vice-presidents of the American Gas & Electric Company, were elected to membership on the board of directors of the American Electric Power Company at the annual meeting held March 18 in Philadelphia. **J. P. Vandervoort** of the legal department of the American Gas & Electric Company was also elected a director of the American Electric Power Company. Other directors were re-elected.

Major William J. Parkes, head of the Parkes Engineering Company of Pine Bluff, Ark., has been named active vice-president of the Louisiana Light & Power Company and will assume charge of the operations of the company in Louisiana April 1. A resident of Pine Bluff since 1906, Major Parkes has been active in civic affairs as well as in engineering circles, serving at the present time his second term as president of the local chamber of commerce and also as president of the Associated Chambers of Commerce of Arkansas. He is also past-president and secretary of the Arkansas Engineering Society.

George W. Lawrence has been elected president of the Greenfield (Mass.) Electric Light & Power Company to succeed Joseph W. Stevens, who has become chairman of the board of directors. On Mr. Stevens' election as president in 1905 he engaged Mr. Lawrence, then with the General Electric Company in Schenectady, for his chief engineer. Mr. Lawrence is advanced to the presidency after serving for some years in the post of vice-president and treasurer. At the annual meeting March 16 **W. Rodman Peabody** was chosen vice-president and **Fred C. Abercrombie** of Turners Falls, Mass., was elected treasurer. Mr. Stevens' service on the board of directors dates from the incorporation of the company in 1886.

F. Douglas Stier, formerly sales manager of the Railway & Industrial Engineering Company at Greensburg, Pa., has been appointed manager of the American Brown Boveri Corporation for the Chicago district. Mr. Stier brings to his new position a broad background of selling experience and an intimate knowledge of industrial conditions in the Middle West. He was educated at St. John's College, Annapolis, Md. From 1911 to 1913 he was in East Pittsburgh, taking the Westinghouse apprenticeship course, terminating with

railway sales work. He did some selling for the Railway & Industrial Engineering Company from St. Louis eastward from 1914 to 1917, and in 1919, following his discharge from military service, he opened an office for that company in Chicago, handling sales in Wisconsin, Michigan, Illinois and Indiana. It was in 1924 that he removed to Greensburg.

Dwight G. Phelps was elected vice-president in charge of sales of the Johns-Pratt Company of Hartford, Conn., at a recent meeting of the board of directors. For many years Mr. Phelps has been sales manager of the Colt's Patent Fire Arms Manufacturing Company, of which the Johns-Pratt Company is an important division.

Harrison D. Panton, for the past three years principal of Harrison D. Panton & Company, engineers of Raleigh, N. C., has joined the organization of Francis R. Weller, consulting engineer, Washington, D. C. Mr. Panton will be stationed at Ocala, Fla., as chief engineer in charge of all Florida-Georgia operations of the Weller organization.

B. J. Martin, who was formerly in charge of the electric truck bureau of the Commonwealth Edison Company, has joined the staff of *Electric Light and Power*, with headquarters in Chicago. Mr. Martin will complete his second term as chairman of the transportation committee of the National Electric Light Association.

Frank H. Richmond, who has been in charge of the investment activities of A. E. Fitkin & Company on the Pacific Coast and public utility enterprises of the Fitkin interests embraced in the system of the National Public Service Corporation, was elected vice-president and director of the Municipal Service Company at a meeting of the board of directors.

L. C. Parks, who has been engaged in power sales work for the Tennessee Electric Power Company for the past three years, has been appointed manager of the company's Cumberland district. Mr. Parks is a native of Otter Lake, Mich., and a graduate of the University of Oregon in electrical engineering. While pursuing his collegiate course he worked for H. M. Byllesby & Company in the Oregon Power Company and remained with that organization until 1914. After removing to the South he engaged in construction work in Tennessee before joining the Public Light & Power Company. It was in the spring of 1921 that Mr. Parks entered the employ of the Chattanooga Railway & Light Company as power sales engineer.

J. W. Blease has been appointed manager of the West Tennessee district of the Tennessee Electric Power Company with headquarters at Waverly. Mr. Blease, who is a native of North Carolina and a graduate of Clemson College in electrical engineering has been affiliated with the Tennessee Electric Power organization only since last June. He formerly spent five years with the Columbia Railway, Gas & Electric Company in South Carolina in various capacities in the meter, line construction and substations departments. Later he joined the Perry Mann Construction Company as manager of the electric construction division, remaining with the company for fifteen years. More recently Mr. Blease has been affiliated with the Blue Ridge Power Company, with headquarters at Spartanburg, S. C.

Obituary

Randal Morgan Dies

Randal Morgan, chairman of the executive and finance committee of the United Gas Improvement Company and an outstanding figure in public utility circles for many years, died at his home in Philadelphia, March 20, in his seventy-second year. Mr. Morgan was a native of the Quaker City and attended the Germantown Academy and the University of Pennsylvania, from which institution he was graduated in 1873. For a short period of time he worked in the Lancaster Iron Works, subsequently entering the law office of his elder brother. After admittance to the bar he became a member of his brother's firm. It was in 1882 that he affiliated himself with the United Gas Improvement Company as counsel. Ten years later he was elected third vice-president and general counsel, in 1904 second vice-president and in 1912 first vice-president. While practicing law as a member of his brother's firm, Morgan & Lewis, Mr. Morgan had acquired a profound knowledge of corporation law and finance which qualified him to assume gradually a leading part in the U. G. I.'s finances, culminating in his selection as chairman of the executive and finance committee almost three years ago.

Mr. Morgan was on the directorate of many public utility companies in various sections of the country and for many years had been prominent in association work. He was a member of the public policy committee of the National Electric Light Association and an active worker in the American Gas Association, having been the founder and moving spirit some few years ago of the emergency committee of the executives of the gas industry which contributed in a substantial manner to its progress.

A. P. Lundberg, founder of the firm of A. P. Lundberg & Son, London, manufacturers of electric light switches, died Feb. 22 at the advanced age of 94.

C. C. Hanna, general superintendent of the Clinton district of the Wabash Valley Electric Company, died Feb. 13 at the Union Hospital, Terre Haute, Ind. Mr. Hanna had been affiliated with the company for fourteen years.

John Holden Vail, pioneer in the electric light and power industry, died March 12 at his home in Rochester. N. Y. Mr. Vail entered upon his career in the electrical industry in 1879 in the laboratories of Thomas A. Edison. In the course of time he had charge of the construction of more than eighty power plants and electric distribution systems in New York, Philadelphia, New Orleans, Rochester and many other cities, as well as being prominently identified with railway electrification. Since 1915 Mr. Vail had been connected with the Rochester Gas & Electric Corporation, having charge of the development of electric trucks and their use, and more recently engaging in research work in connection with the distribution of heat from central heating plants.

John McGrady, president of the Worcester Electrical & Manufacturing Company, died March 12 at Worcester, Mass. He was widely known among electrical manufacturers in the Northeast and had been at the head of the above company for many years.

Charles C. Gray, general sales manager of the Detroit Insulated Wire Company, died March 16 at his home in Detroit after a few hours' illness. Mr. Gray was a native of Pittsburgh and for many years was connected with the Westinghouse interests in that city, later becoming identified with the National Wire & Cable Company, also of Pittsburgh. In 1912 he became associated with the Detroit Insulated Wire Company at Detroit as general sales manager, an association which continued up to the hour of his death. Mr. Gray was 54 years of age.

Heike K. Onnes, emeritus professor and director of the physical laboratory at Leyden University, Leyden, Holland, died last January in his seventy-third year. Professor Onnes had been the recipient of many distinctions in the scientific field, including the Nobel prize for physics in 1913, the Franklin Institute medal in 1915 and the Rumford medal of the British Royal Society in 1916. He was born at Groningen, and became professor of experimental physics in 1882 at Leyden, where he carried out researches on gases at high pressures and low temperatures, which culminated in the liquefaction of helium in 1908 at 4.5 deg. on the absolute scale.

Charles G. M. Thomas, vice-president of the Consolidated Gas Company of New York and for many years prominently identified with other public utility companies in New York and vicinity, died of pneumonia March 20 at his home in Flushing, Long Island. Mr. Thomas entered the public utility field in 1888 as an employee of the Standard Gas Light Company, following a short affiliation with the insurance business. From that date until 1907 he served as an official of several gas companies, and in that year he became a director and vice-president and general manager of the New York & Queens Electric Light & Power Company. Six years later he was elected to the presidency and in 1916 to the chairmanship of the board, which office he occupied up to the time of his death. After serving as treasurer of the Consolidated Gas Company for eight years he was made vice-president in 1924. In addition to his connection with the Consolidated company and with the New York & Queens organization he was a vice-president of the Bronx Gas & Electric Company and treasurer of the Astoria Light, Heat & Power Company. Mr. Thomas was a past-president of the Empire State Gas & Electric Association and a member of the American Institute of Electrical Engineers and of the Illuminating Engineering Society.

Commission Rulings

Arriving at Amount of Final Minimum Bill.—Until a final bill is rendered, the day on which the meter is read and bill rendered is not important, said the New Jersey Board of Public Utility Commissioners in a case involving the Atlantic City Electric Company; but a final minimum bill should be computed in relation to the proportionate part of the billing month which elapsed prior to discontinuance of service.

Oklahoma Commission Upholds Revocable Permit Act.—The Oklahoma Corporation Commission, in granting revocable permits to the Oklahoma Gas & Electric Company to serve Ada with electricity and the MacThwaite Oil & Gas Company to give gas service to the same city, overruled a contention of the city attorney that the commission had no jurisdiction to act in these cases because the revocable permit law violates the charter rights of Ada and is contrary to the constitution of the state. The commission, held that it must assume the law is valid and constitutional unless set aside by the Supreme Court, that its duties in this connection were purely ministerial and that it had no discretion whatsoever, but must grant the permits.

Blanket Charges by Holding Companies Condemned. — The practice of certain holding companies in making blanket percentage charges to operating utility companies whose stock they own was characterized as "simply a process of milking the patrons of the utility and obtaining an enhanced return on investment" in an order written by the Indiana Public Service Commission granting increased railway fares to the Southern Indiana Gas & Electric Company of Evansville, Ind. The contract criticised is between that company and the Commonwealth Power Corporation, a New York holding company, and provides for the payment of a percentage of expenditures for extensions and betterments to the electric, gas, heat-earnings. This contract, the commission said, "may have considerable bearing when consideration is given to the gas, electric or heating departments which the same company owns, and we wish to be understood as not placing the seal of approval on such contract in this proceeding." The various departments of the Southern company are operated as one company and have the same local management. The directors in 1922, the commission said, adopted a resolution providing that the Commonwealth Power Corporation should receive 3 per cent of the total cost of all extensions and betterments to the railway properties; 6 per cent of the total costs of extensions, additions and betterments to the electric, gas heating and other properties, and 2 per cent of the entire gross earnings from all departments of the company as compensation for general management and supervision service. The order pointed out that under the terms of the agreement the Southern company in 1925 paid to the Commonwealth Power $43,752 for engineering services on account of extensions and betterments and $55,440 for other services, a total of $99,192. It pointed out also that $42,000 a year is paid by the utility for engineering services and that this amount is carried to the capital account. The ratepayer thereafter is taxed to pay a fair return on this amount, while at the same time the utility passes to the holding company $42,000 for engineering charges, charging it to the cost of operation, and the same is paid by the ratepayer. Thus, the commission contends, the ratepayer pays the amount in the first instance and thereafter, so long as the property remains in the service, pays to the holding company an annual return on the money thus expended. "Such methods of operation will not be tolerated," the commission order said.

Recent Court Decisions

Considerations of Negligence in Case Where Pole Step Broke Under Weight of Lineman.—Reversing a verdict for the plaintiff, a lineman who recovered damages for injury caused by the breaking of a step on an electric light pole which, he alleged, was unsafe owing to the negligence of his employer (Kramer vs. Kansas City Power & Light Company), and ordering a new trial, the Supreme Court of Missouri held that it was necessary for the lineman to allege and prove that this negligence caused his injury, that instructions directing the jury to find for the plaintiff on his contention that the company had failed to drive the step into the pole far enough were erroneous where the allegation and proof just indicated were not made, that whether the breaking of the step was caused by latent defects or by long use and corrosion was one of fact for the jury to determine, and that whether the lineman was guilty of contributory negligence in failure to inspect the step was also, in view of the fact that it was snowing and the step was covered with snow, for the jury. (279 S.W. 43.)*

Pacific Gas & Electric Wins Market Street Railway Suit.—Applications for injunctions filed by the Market Street Railway Company of San Francisco against the Pacific Gas & Electric Company to prevent the latter from collecting $425,000 and accrued interest from the former have again been dismissed by federal court judges in California. (See ELECTRICAL WORLD for June 20, 1925, page 1366.) The filing of the injunction pleas followed the decision rendered by the Superior Court in the original suit brought by the railway company against the power company in a dispute over rates for electric power fixed by the California Railroad Commission. The railway company contended that increases allowed by the railroad commission over rates stipulated in a certain agreement existing between the two companies were illegally authorized as the power supplied under the contract never became a public utility because the contract was private, thus barring the commission from jurisdiction. The decision just rendered says: "Plaintiff's rights are to be measured solely by the external limits of 'undue process,' and if there is no allegation that the commission transgressed those limits, it has no standing in federal court; for here only constitutional questions may be considered. . . . The increases first made were temporary, were measured by accurate gages of increases, and were followed within reasonable time by a rate based on full and complete valuations of the properties involved, which demonstrate their essential fairness."

What Constitutes an Indeterminate Permit?—The fight to serve the municipal plant of Clintonville, Wis., with power has been decided in favor of the Wisconsin Traction, Light, Heat & Power Company, Appleton, under a decision just handed down by an inferior court at Stevens Point, which held that the Central Wisconsin Power Company, now owned by the Wisconsin Power & Light Company, had defaulted on its ten-year power contract with the city of Clintonville and that its franchise in that city was not an indeterminate one. From Jan. 7, 1919, until June, 1925, the Central Wisconsin Power Company was only able to supply part of the city's requirements for power, although the contract required the company to carry the whole load. Attorneys for the city maintained that as far back as 1922 the company had defaulted on its contract, the city having been compelled to operate its own steam plant for 41 days during that year, 39 days in 1923, 55 days in 1924 and 60 days in 1925. In 1925 a contract was closed with the Wisconsin Traction, Light, Heat & Power Company to supply the city's current needs. The Central Wisconsin Power Company then challenged the right of the Appleton utility to infringe on its territory by selling energy to Clintonville without first having a certificate of convenience and necessity from the Railroad Commission. The terms of the new contract were later approved by the commission, although it did not pass upon its legality. Concerning the most important question in this litigation, whether or not the Central Wisconsin Power Company possessed an indeterminate permit to serve Clintonville to the exclusion of all others, the court declared that "it is held that an indeterminate permit does not result merely from the granting of opportunity which is accepted by some constructive work and service by the utility; that if acquired it may be lost, defeated or revoked for cause." He added that the franchise to the power company to furnish service was not accepted by construction of lines and actual service to prospective customers, and that the acknowledged and conceded default in service to the city under the contract and ordinance operate to defeat the power company's right to claim an indeterminate permit, if it ever had such right. The case will probably be appealed.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Market Continues Lower

Second Severe Break in Prices Occurs Wednesday—Recession in General List Reflected in Utility Values

CONTINUED pronounced contraction in loans shows plainly that liquidation of stocks in the market recently has been heavy in the various groups. Loans reported by members to the Federal Reserve Bank at New York fell $61,000,000 in the week ended March 3, which was the period of most drastic reaction, but, interestingly enough, in the following week loans fell another $162,000,000. The weakness revealed in the market for listed stocks generally was apparent both in the listed and unlisted market for power and light stocks. While conditions in the industry remain sound and money still is relatively easy, the widespread desire to sell while values are falling has tended to accelerate the decline in many instances beyond its rightful pace, just as the desire to buy when values were rising had a tendency to accelerate the advance.

Declines in prices ranging from two to four points for the week were numerous in the list, but, it must be added, liquidation was not heavy for the most part. Recent losses have been suffered not so much from the fact that large blocks of stock have been forced upon the market, as was the case two or three weeks ago, but from the fact that at the moment the demand for shares has temporarily diminished, just as it has in the case of stocks in other departments.

Among the utility stocks that lost ground were Tampa Electric, United Gas Improvement, United Light & Power, class A, Southeastern Power & Light, Electric Bond & Share, American Gas & Electric, American Power & Light, General Gas & Electric, class B, American Light & Traction, Southern California Edison and Puget Sound Power & Light. General Electric lost considerable ground during the week.

New Capital Issues

During the past week the Oklahoma Gas & Electric Company made a four-million-dollar offering in the form of first mortgage 5 per cent gold bonds priced at 95 and interest, to yield about 5.37 per cent.

First mortgage and refunding 5½ per cent gold bonds of the Northern Connecticut Power Company were issued to the amount of $2,100,000, the price being 97½ and interest, to yield 5.71 per cent. An offering of similar size was made by the Pennsylvania Gas & Electric Corporation in the form of 6 per cent gold debentures, priced at 93½ and accrued interest, to yield about 6.45 per cent.

The W. B. Foshay Company offered 7 per cent cumulative preferred stock to the amount of $250,000 with the purpose of raising funds for the further expansion of the company's business. This stock was priced at par and accrued dividends.

A five-million-dollar loan was floated by the Servel Corporation in the form of 6 per cent convertible notes, dated April 1, 1926, and maturing April 1, 1931.

Public Service Corporation Plans Customer Ownership Campaign. — On April 1 the Public Service Corporation of New Jersey will launch another campaign of stock selling through its employees, when 50,000 shares of 6 per cent cumulative preferred will be offered at $100 a share and accrued dividend, either for cash or on terms of $10 down and $10 a share per month, the amount of accrued dividend to be included in the last installment paid. Interest at the rate of 6 per cent per annum will be paid on such installments, adjustments being made when the stock is delivered. The stock will be sold by employees of the corporation and its subsidiaries.

Company Reports

Name of Company	Gross Earnings for February 1926	1925
Adirondack Power & Light	$763,812	$710,395
Alabama Power	1,060,197	819,647
Baton Rouge Electric*	85,302	74,018
Blackstone Valley Gas & El.*	505,508	474,056
Central Illinois Light	369,586	360,856
Cities Service	1,819,937	1,561,189
Commonwealth Power	4,106,744	3,668,163
Community Power & Light*	297,300	256,627
Consumers Power	2,007,098	1,721,969
Detroit Edison†	3,806,817	3,106,037
Edison Elec. Illg. of Brockton*	170,280	171,429
Electric Lt. & Pwr. Company of Abington & Rockland*	53,382	42,018
El Paso Electric*	241,620	223,606
Galveston-Houston Electric*	333,586	326,122
Houghton County Elec. Light*	52,506	52,814
Illinois Power	240,056	222,827
Kansas City Power & Light	935,532	899,516
Lowell Electric Light*	171,838	158,180
Massachusetts Lighting	333,462	309,311
Northern Ohio Power	1,035,295	926,962
Northern Texas Electric*	210,060	220,530
Ohio Edison	166,526	136,968
Portland Electric Power*	1,022,738	971,332
Puget Sound Power & Light*	1,255,795	1,184,549
Savannah Electric & Power*	193,302	170,238
Sierra Pacific Electric*	98,586	100,329
Southern Indiana Gas & Elec.	233,588	222,499
Tampa Electric*	440,484	264,975
Tennessee Electric Power	980,521	900,710
Winnipeg Electric*	507,833	504,814

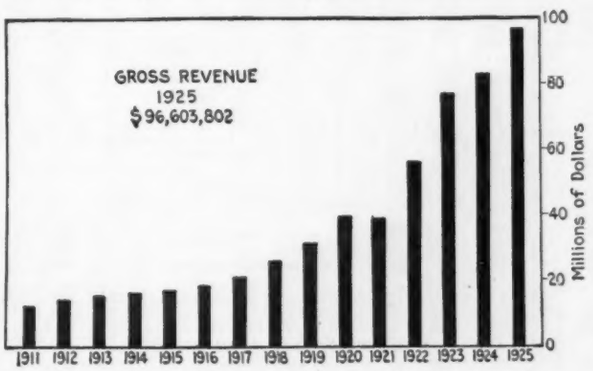
*January. †Includes other revenue.

North American Unique Dividend Policy

Now Beginning Upon Fourth Year Since Adoption of Plan—Gross Revenues Have Risen to an Annual Rate of More than $93,000,000

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

MOST power and light companies on a dividend basis make payments to their common stockholders in cash, several pay partly in cash and partly in stock, but the North American Company has inaugurated a new method of payment—it pays entirely in common stock. The dividend declared Feb. 19, 1926, marked the beginning of the fourth year since this large utility began its present common-stock dividend policy.



GROSS REVENUE OF COMPANY SHOWS CONSISTENT GROWTH

From the company's standpoint the advantage of the plan is that the management is enabled to keep the available funds at work in the properties. Stockholders are benefited by the acceleration in the growth of the plant thus made possible, and, of course, the marketability of the stock enables stockholders that must have cash to obtain it by selling their dividend stock. The latter is, incidentally, in all respects identical with the regular common stock of the company.

In the North American Company's new and interesting annual report Frank L. Dame, president, has the following to say about the dividend policy:

"Some of our new stockholders may not realize that this dividend policy is really a combination of dividends and rights and, therefore, that the amount of cash realized by them on a sale of the dividend stock bears no direct relation to earnings. The company could, of course, pay dividends in cash and then at longer intervals offer to common stockholders a considerably larger proportion of common stock, for sub-

scription at par, with about the same result for such stockholders, except the possible inconvenience to them of having either to provide a large amount of cash at one time to take up the common stock so offered for subscription, or to sell their subscription rights. The stockholder would then pay a tax on his cash dividend, and if he did not find it convenient to exercise his subscription rights, the proceeds of their sale would also be taxable. Under the present dividend policy there is no present federal tax liability unless the sale of dividend stock is effected, and then the tax applies only on the difference between the sale price of the stock disposed of and the average cost of the entire holding including the dividend stock."

The annual gross revenues of the system have increased persistently, and in 1925, the thirty-sixth year for the utility, such revenues reached a new high total of $93,028,966. The North American Company is one of the largest enterprises in the country and is the largest power and light utility under a single ownership that is in existence at the present time.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday March 20	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com.			
—no par	k 77¼	71¼	84½
Adirondack Pwr. & Lt.—7% pf.	k103½	....	....
Adirondack Pwr. & Lt.—8% pf.	108	108	110
Adirondack Pwr. & Lt., com.—50	m 75	n 31	n 98
Ala. Pwr., pf.	k104	....	....
Allis-Chalmers Mfg. pf.	107	107¼	110
Allis-Chalmers Mfg., com.	k 83¼	82¼	94½
Aluminum Co. of Amer., com.	k 65¼	54½	76
Aluminum Co. of Amer. new, pf.	k 99	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m125	127½	131
Amer. & Foreign Pwr., 7% pf.—no par	k 92½	91½	98
Amer. & Foreign Pwr., com.—no par	k 24	22	42½
Amer. Bosch Magneto, com—no par	k 22½	20	34½
Amer. Brown Boveri, Elec.	k 36½	33½	48
Amer. Brown Boveri Elec. pf.	k 91½	88	97½
Amer. Elec. pwr., pf.	c109½	101½	109½
Amer. Gas & Elec., 6% pf.—no par.	k 92½	....	....
Amer. Gas & Elec., com.—no par	k 73	64	99½
Amer. Lt. & Trac., 6% pf.	k106	106	116½
Amer. Lt. & Trac., com.	k212	197	263
Amer. Pwr. & Lt., 6% pf.	k 93½	92½	94
Amer. Pwr. & Lt., com.—no par	k 55	50	79½
Amer. Pub. Serv., 7% pf.	k 94	....	....
Amer. Pub. Serv., com.	47	45	80
Amer. Pub. Utilities, 4% pf.	k 87	....	....
Amer. Pub. Utilities, 6% pf.	k 86	k 85	86
Amer. Pub. Utilities, 7% pf.	k 90	....	....
Amer. Pub. Utilities, com.	78	80	82
Amer. States Sec., A	k 2	....	....
Amer. States Sec. B	k 1	....	....
Amer. Superpwr., pf.—25	k 24½	24½	26½
Amer. Superpower, pf.	90½	93	94
Amer. Superpwr., Class A—no par.	k 23	22	37½
Amer. Superpwr., Class B—no par.	k 25	22½	39
Amer. Wtr. Wks. & Elec., 7% pf.	k101½	101½	108½
Amer. Wtr. Wks. & Elec., com.—20.	k 53½	48	74
Anaconda Copper	k 45½	42	51
Appalachian Pwr., 7% pf.	100	99	101
Appalachian Pwr., 1st pf., 7%	102	99	101
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	k 78	....	....
Arizona Pwr., com.	m 27	27	35½
Arkansas Cent. Pwr., pf., $7—no par	103	99	102
Arkansas Lt. & Pwr., 7% pf.	k 96½	....	....
Arkansas Lt. & Pwr., com.	115	110	115
Asheville Pwr. & Lt., 7% pf.	l104	100½	104
Assoc. G.&E., 7% pf.—1% extra—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 78	....	....
Assoc. Gas & Elec., Class A—no par	k 28½	....	....
BABCOCK & WILCOX, com.	k140	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	....	....
Birmingham Elec. pf.—$7—no par	101	101	103½
Blackstone Valley Gas & Elec., pf.	100	102	106
Blackstone Valley G.&E., com.—50.	90	....	....
Blaw-Knox, com.	m47½	45	56
Brasilian Trac., Lt. & Pwr., com.	f 90½	....	....
Broad River Pwr., pf.	k 93	....	....
Brooklyn Edison, com.	k138	133½	146½
Buffalo Gen. Elec., com.—no par.	m 58	n 50	n 77
Buffalo, Niagara & East. Pwr., pf.—25	k 24	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	k 27	....	....
CALIFORNIA ELEC. GENERATING, pf.	90	89	93
California Ry. & Pwr., pf.	87	88	92
Carolina Pwr. & Lt., pf.—$7—no par	103½	104	107
Carolina Pwr. & Lt., com.	m420	n290	n456½
Cent. & S. W. Ut. 7% pf.—no par	a 92	89½	94
Cent. & S. W. Ut., pr. ln. pf.—no par	a 96	95½	100
Central Aris. Lt. & Pwr., pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	k100	....	....
Central Ill. Pub. Serv., 6% pf.	89	89	91
Central Ind. Pwr., 7% pf.	89	89	93½
Central Pwr. & Lt., pf.	97½	95½	98
Central States Elec., 7% pf.	93	93	95½
Central States Elec., com.	m200	200	230
Century Elec., com.	m103	n103	n110
Chicago Fuse Mfg., com., no par.	a 30½	30½	35
Cincinnati Gas & Elec., com.	g 92½	89	95
Cities Service, 6% pf.	k 83	....	....
Cities Service, pf.B—10	k 7½	....	....
Cities Service, pf. BB—100	k 75	....	....
Cities Service, com.—20	k 41½	....	....
Cities Service, Bks. Shrs.—10.	k 20½	....	....
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Ilu., 6% pf.	103	103	105½
Cleveland Elec., Illg., com.	k240	....	....
Colorado Pwr., 7% pf.	k 96	....	....
Columbia Gas & Elec., 7% pf.	112	113	115
Columbia Gas & E., com.—no par.	k 75½	72	90
Columbia Ry., Gas & Elec., 6% pf.	95	95	96
Columbus Elec. & Pwr., 2d pf.	k101	....	....
Columbus Elec. & Pwr., com.	k180	....	....
Columbus Ry., Pwr. & Lt., 1st. pf.	97½	98	99
Columbus Ry., Pwr. & Lt., pf. B.	93	92	95
Col. Ry., Pwr. & Lt., com.—no par.	82	82	85
Commonwealth Edison, com.	a141	131	144
Commonwealth Pwr., 6% pf.	k 84½	....	....
Commonwealth Pwr., com—no par.	k 34½	28½	42½
Conn. Lt. & Pwr., 8% pf.	118	118	121
Conn. Lt. & Pwr., 7% pf.	110	110	113
Cons. Gas of N. Y., pf.—50.	k 57½	....	....
Cons. Gas of N.Y., com.—no par	k 93½	90½	104½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e 103½	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf.	e109½	108½	110
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e113½	110½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e125½	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 50½	45	57½
Cons. Utilities of Dela., 7% pf.	m 85	n 80	n 84
Consumers Pwr., 6% pf.	95½	95	98
Consumers Pwr., 6.6% pf.	101½	101½	103½
Continental Gas & Elec., 7% ptc. pf	k 95	....	....
Continental Gas & Elec., 7% pr. pf.	k 92½	....	....
Continental G.&E., com.—no par.	m125	130	150
Crocker Wheeler, com.	18	14	19
Crocker Wheeler, pf.	50	50	55
DALLAS PWR. & LT., 7% pf.	104	102	104
Dayton Pwr. & Lt., 6% pf.	97½	95	97
Dayton Pwr. & Lt., com.	m420	n180	n460
Detroit Edison, com.	k125½	124½	141½
Dubilier Condenser & Radio, com. no par	k 6½	6	11
Dubuque Elec., 6% pf.	95	93	97
Duquesne Lt., 7% pf.	k112½	111½	114
EAST. N. Y. UTIL. pf.	85	....	....
Eastern New York Utli., com.	75	....	....
Eastern States Power	23	23	32½
Eastern States Pwr., pf. with warrants	m120	....	....
Eastern States Pwr., pf. without warrants	k 90	....	....
Eastern Tex. Elec., 7% pf.	k102	....	....
East. Tex. Elec., com.—no par.	105	103	107
Edison Elec. Illum. of Boston, com.	d227	207	250
E. Paso Elec., com.—no par	k 85	....	....
E. Paso Elec. pf.	k102	....	....
Elec. Bond & Share, 6% pf.	l105½	103½	107½
E. Bd. & Share Sec., com.—no par.	l 63	63	86
Elec. Investors, 6% pf.—no par.	91	92	95
Elec. Investors, com.—no par.	k 42½	40	74½
Elec. Investors, 10% pd. receipts	24	....	....
Elec. Pwr. & Lt., ctfs., pf.	k 92	90½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	102½	102	115
Elec. Pwr. & Lt., ctfs. full pd.	100	107	110½
Elec. Pwr. & Lt., ctfs., com.—no par	k 21½	18	34½
Elec. Ry. Securities, com.—no par.	m 5	....	....
Elec. Refrig.	k 65½	59½	90½
Elec. Storage Battery, com.—no par.	k 77½	71½	79½
Elmira Wtr., Lt. & R. R., 7% pf.	98	97½	99½
Emerson Elec. pf.	m102½	100	104½
Empire Dist. Elec., 6% pf.	86	80	85
Empire Pwr., A	k 25	....	....
Eng. Pub. Serv., pf.—no par	k100	98½	104
Engr. Pub. Serv., com.—no par.	k 25½	24	29½
Eureka Vac. Cleaner, com.—no par.	k 48	47	53½
FAIRBANKS MORSE, com—no par	50½	49	59½
Fairbanks Morse, pf.	111	108½	115
Federal Lt. & Trac., com.	k 32	28½	39½
Federal Light & Traction, pf.	86½	87	89
Federal Utilities, pf.	k 75	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l106	105	107
GALVESTON-HOUSTON ELEC., 6% pf.	k 57	....	....
Galveston-Hstn El., com.	k 20	....	....
Gen. Elec., com.	k314½	302	385½
Gen. Elec., special—10.	k 11½	11	11½
Gen. Gas & Elec., A	42	42	59
Gen. G.&E., (Del.) com. A no par.	42	42	59
Gen. G.&E., (Del.) com. B no par.	k 32	....	....
Gen. G.&E., (Del.) A pf. $8—no par	106½	108½	110½
Gen. G.&E., (Del.) A pf. $7—no par	96	96	99½
Gen. G.&E., (Del.) B pf.	94	95½	96
General Public Service, pf.	101½	101½	106½
General Public Service, com.	m15	13½	16½
Ga. Lt., Pwr & Rys., 6% pf.	82	82	85
Ga. Lt., Pwr. & Rys., com.	m 58½	58	75
Ga. Ry. & Elec., 5% pf.	m 70	n 78½	n 84½
Ga. Ry. & Elec., com.	m126	n115½	n115½
Ga. Ry. & Pwr., 8% pf.	112	112	114
Ga. Ry. & Pwr., 7% pf.	101	101½	103
Ga. Ry. & Pwr., 4% pf.	m133	....	....
Ga. Ry. & Pwr., com.	m133	....	....
Gt. Western Pwr., 7% pf.	k100½	....	....
HAVANA ELEC. UTIL., com.	43½	43	44½
Havana Elec. Util., pf.	k 70½	67	71½
Hurley Machine, com.—no par.	m 50½	44½	51
IDAHO PWR., 7% pf.	104	103	104
Ill. No. Utilities, 6% pf.	90	88	92
Ill. Pwr. & Lt., 7% pf.	k 97½	....	....
Ingersoll Rand	88	87	104
Int. Combus. Engr., com.—no par.	k 46½	40	64½
Int. Utilities, class A—no par.	k 31	....	....
Int. Utilities, class B—no par.	k 5½	5	9½
Interstate Pwr., pf., $7 no par.	k 92	....	....
Interstate Pub. Serv., 7% pf.	95	96½	97
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT. 7% pf.	95	95½	96½
Jersey Central Pwr. & Lt., com.—no par	45	45	50
Johns-Manville, com.—no par.	139½	136	159
KANSAS CITY PWR. & LT., pf.	107½	107½	110½
Kansas Gas & Elec., 7% pf.	l101	99½	102
Kelvinator Corp., com.—no par.	m 76	76	89½
Kentucky Hydro-Elec., pf.	a 94½	92	95
Kentucky Sec., 6% pf.	79	75	77
Kentucky Sec., com.	k 90	....	....
Kentucky Utilities, 6% pf.	90	90	95
Keystone Pwr. & Lt. 7% pf.	95½	95	97
Kings County Ltg., 7% pf.	103	103	106
Kings County, Ltg., 8% pf.	105	105	108
LACLEDE GAS LT., com.	153½	152	168
Lehigh Pwr. Sec., com.—no par.	k 13	10	23
Long Island Ltg., 7% pf.	106½	105	107
Long Island Ltg., com.—no par.	125	145	150
Los Angeles Gas & Elec., 6% pf.	96	95½	97
Louisville Gas & Elec., Class. A	k234½	22½	26½
MANHATTAN ELEC. SUPPLY.	k 69½	56	76½
Manila Elec., com.—no par.	29½	29½	35
Maytag Mfg., com.	k 20	19	23½
Memphis Pwr. & Lt., pf., $7, no par	105	103	105
Metro. Edison, pf.—$6—no par.	k 92	....	....
Metropolitan Edison, pf., $7, no par.	k101	....	....
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a107½	97½	111½
Middle West Utilities, 7% pr. lien pf.	a116½	106½	123½
Middle West Utilities, com.—no par.	a115½	109	134½
Midland Utilities, pr. ln. pf.	a 99½	99	100
Midland Utilities pf. A	a 97½	96	98
Milwaukee Elec. Ry. & Lt., 7% pf.	100	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	91	....	....
Minn. Pwr. & Lt., 7% pf.	l102	100½	103½
Miss. Pwr. & Lt., pf.	k102	....	....
Miss. River Pwr., 6% pf.	94	94	96
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	103	101	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par	95	99	97
Mohawk Hudson Pwr., com.—no par	k 23½	21½	28½
Montana Pwr., pf.	k114	112½	119½
Montana Pwr., com.	k 73½	71	83½
Montreal Pwr., com.	f 219½	....	....
Mountain States Pwr., pf.	k 96	....	....
Mountain States Pwr., com.	k 23	....	....
NASSAU & SUFFOLK, LTG., pf.	93	93	95
National Carbon, com.	m124	n120	n130
National Carbon, pf.	m126	125	127½
National Elec. Pwr., pf.	a 94	93	96½
National Electric Pwr-A	a 20½	20	26
Nat.-Lt., Ht. & Pwr., com.—no par.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	k 99	....	....
National Pwr. & Lt., com.—no par.	k 21½	16½	38½
National Pub. Serv., 7% pf.	89	90	94
National Pub. Serv., ptc. pf.	95	96	97½
National Pub. Serv., A com.—no par	18½	15½	24
National Pub. Serv., B com.—no par	13½	10	17½
Nebraska Pwr., 7% pf.	l105	103	105½
Nevada-Calif. Elec., com.	k 23	18½	42
New Brunswick Pwr., pf.	35	30	40
New England Pub. Serv., pr. in. pf.	96½	98	99½
New England Pub. Serv., pf.	88	95½	97
N. J. Pwr. & Lt., 7% pf.	103	104	108
New Orleans Pub. Serv., 7% pf.	101	100	102
New Orleans Pub. Serv., com.—no par	m 30	n 31	n 38½
N. Y. Central Elec., 7% pf.	98½	98	100
Newport News & Hampton Ry., Gas & Elec., com.	108	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	108	109	114
Niagara Falls Pwr., 7% pf.—25	k 28	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	108	110	111½
Niagara, Lock. & Ont. Pwr., com.—no par	m 60½	n 60	n 73
Niser Corp., A.—no par	m 84½	n 37	n 84½
Niser Corp., B.—no par	m 69	60	89½
No. Amer., 6% pf.—50.	k 50	49	50½
No. Amer., com.—10.	k 52	47½	67
No. Amer. Edison pf.—no par.	k 93½	92½	95½
No. Amer., Lt. & Pwr., pf.	92	88	90
N.C. Pub. Serv., pf.—$7—no par.	k 90	....	....
Northeastern Pwr., com.	k 22	20½	36½
No. Indiana Gas & Elec., pf. A.	100	98	100
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 16	15½	26½
No. Ohio Trac. & Lt., 6% pf.	78	78	81
No. Ohio Trac. & Lt., 7% pf.	88	88	91
No. Ont. Lt. & Pwr., pf.	k 79	....	....
No. Ont. Lt. & Pwr., com.	52	45	68
No. States Pwr., 7% pf.	k101½	99½	101½
No. States Pwr. com.	k107½	101½	136½
No. Texas Elec., 6% pf.	m 58	60	65
No. Texas Elec., com.	m 40	40	45
OHIO BRASS, com. B—no par.	70	70	79
Ohio Brass, pf.	98	98	101
Ohio Gas & Elec., 7% pf.	90	92	95
Ohio Pwr., 6% pf.	93½	93	95
Ohio Pub. Serv., 6% pf.	90	90	93
Ohio Pub. Serv., 7% pf.	99	98½	100
Ohio River Edison, pf.	99½	99½	101½
Oklahoma Gas & Elec., pf.	k 95	....	....
PACIFIC GAS & ELEC., 6% pf.	k 98	....	....
Pacific Gas & Elec. com.	k124	122	132½
Pacific Pwr. & Lt., 7% pf.	l100½	98	101½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, March 23. lBid, low, high, Wednesday, March 24. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday March 20	Low 1926	High 1926
STOCKS—Continued			
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt. & Pwr., pf.—no par	c 71½	71½	73½
Penn-Ohio Elec., 7% pf.	95½	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	96	94	97
Penn-Ohio Pwr. & Lt., 8% pf.	103	100	106
Penn Pwr. & Lt.—$7—no par	l105	103	106½
Penn Pub. Serv., 7% pf.	98	96	100
Penn Pub. Serv., 6% pf.	86	85	90
Penn Wtr. & Pwr., com.	e152	150	171
Phila. Co., 5% pf.—50	m38	37	38
Phila. Co., 6% pf.—50	k 50	47	50½
Phila. Co., com.—50	k 65	59	70½
Phila. Elec., com.—25	c 48	43	67
Pittsburgh Utilities, pf.—10	k 16½	14	16½
Portland Elec. Pwr., 7% pf.	98	97	98
Portland Elec. Pwr., 6% pf.	73	71	75½
Portland Elec. Pwr., com.	k 42	....	....
Portland Ry., Lt. & Pwr., pf.	m 72½	....	....
Portland Ry., Lt. & Pwr., com.	m 49	....	....
Potomac Elec. Pwr., pf.	j106½	....	....
Pwr. Corp. of N. Y., 7% pf.	m110	n 96	n112
Pwr. Corp. of N.Y., com—no par	m 79	77½	90½
Pwr. Sec., pf.—no par	k 18	....	....
Pwr. Sec., com.—no par	k 9	....	....
Pub. Serv. of N. J., 7% pf.	k105½	103½	108½
Pub. Serv. of N. J., 8% pf.	k117	115	119
Pub. Serv. of N. J. com.—no par	k 78½	72	92½
Pub. Serv. of No. Ill., 6% pf.	a102	100½	102½
Public Serv. of No. Ill., 7% pf.	a116½	112	116½
Pub. Serv. of No. Ill., com.—no par	a132½	130	137
Pub. Serv. of No. Ill., com.	a131	130	135
Pub. Serv. of Okla., 7% pf.	93	92	95
Pub. Serv. Elec. & Gas, 6% pf.	k 97½	97	99½
Puget Sound Pwr. & Lt., 7% pf.	k107	....	....
Puget Sound Pwr. & Lt., 6% pf.	k 83	....	....
Puget Sound Pwr. & Lt., com.	k 52	45	66½
RADIO CORP. OF AM., pf.—50	46½	44½	47½
Radio Corp. of Amer., com.—no par	k 34½	32½	46½
Republic Ry. & Lt., pf.	k104	....	....
Republic Ry. & Lt., com.	85	83	97
Rochester Gas & Elec., 5% pf.	95	80	98
Rochester Gas & Elec., 6% pf.	101½	100	102
Rochester Gas & Elec., 7% pf.	104	105	107
ST. JOSEPH RY., LT., HT. & PWR., pf.	65	60	65
Servel Corp., Class A	k 23½	20½	30½
Servel Corp., Class B—no par	k 40	....	....
Sierra Pacific Elec., com.	k 26½	23	28½
Sioux City Gas & Elec., 7% pf.	98	96	98
S. R. Pwr. & Lt., pf.—$7—no par	98	97	100
S. E. Pwr. & Lt., com.—no par	k 27½	24	46½
So. Calif. Edison, 8% pf.	135	135	140
So. Calif. Edison, 7% pf.	k110	....	....
So. Calif. Edison, 6% pf.	k 97½	....	....
So. Calif. Edison, com.	k123½	115½	142
Southern Cities Utilities, 7% pf.	87	86	89
Southern Cities Utilities, com.	k 31	31	49
Southern Pwr. & Lt. of Md., pf.	m107	....	....
Southern Pwr. & Lt. of Md., com.	m 32	....	....
Southwestern Lt. & Pwr., A	k 55	....	....
Southwestern Lt. & Pwr., B	k 45	....	....
Southwestern Lt. & Pwr., $6 pf.	k 80	....	....
Southwestern Pwr. & Lt., 7% pf.	k101	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	96	....	....
Standard Gas & Elec., 8% pf.	k 56½	54½	57½
Standard Gas & Elec., 7% pf.	k101½	....	....
Standard Gas & Elec., com.—no par	k 57	51	69
Standard Pwr. & Lt., 7% pf.	k 91½	....	....
Superheater, com.—no par	k139	....	....
Syracuse Lighting, 7% pf.	105	105	107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	290	260	302
TAMPA ELEC., com.	k284	284	330
Tenn. Elec. Pwr., 6% pf.	k 88	....	....
Tenn. Elec. Pwr., 7% pf.	k100	....	....
Tenn. Elec. Pwr., pf.—$6—no par	m 80	....	....
Tenn. Elec. Pwr., com.—no par	m 65	23	37
Terre Haute, Ind. & East Trac., pf.	20	3	5
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf.	l104	102	105
Tide Water Pwr., 8% pf.	k 98	....	....
Timken Roller Bearing, com.—no par	k 50½	44½	56½
Toledo Edison, 8% pf.	112	112	114
Toledo Edison, 7% pf.	101½	101	103
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	88½	87½	89
UNITED GAS & ELEC., 6% pf.	94	94	97
United Gas & Elec., com.—no par	m57	56	66
United Gas & Elec. (N.J.), 5% pf.	68	70	75
United Gas Impr.—50	c 95	91	144½
United Lt. & Pwr., pf.—$4—no par	43	....	51
United L. & P. pf.—$6.50—no par	80	81	91
United Lt. & Pwr., com., A—no par	k 78	70½	143½
United Lt. & Pwr., com., B—no par	k 81	140	165
Utah Pwr. & Lt., 7% pf., ex. div.	l102	99	103½
Utica Gas & Elec., 7% pf.	105	103	105
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	k 92	....	....
Utilities Pwr. & Lt., com. B—no par	k 16	15	18½
VERMONT HYDRO - ELEC., 7% pf.	95	95	96
Virginian Pwr., 7% pf.	105	102	104
Virginian Pwr., com.	65	....	....
Virginia Ry. & Pwr., com.	m150	150	150
WAGNER ELEC., pf.	m 80	80	85
Wagner Elec., com.—no par	b 26½	25½	34½
Washington Ry. & Elec., com.	j205	....	....
Washington Ry. & Elec., pf.	j 90½	....	....
Washington Wtr. Pwr., com.	130	130	134
West Mo. Pwr., 7% pf.	k 91	....	....
West Penn., 7% pf. temp. ctfs.	99	95½	101
West Penn, com.	k125	118	130
West Penn Elec., pf.	97½	96½	100½
West Penn Elec., Class A	90	88½	97
West Penn Pwr., pf.	k109½	108½	112
West Va. Lt. Ht. & Pwr., 7% pf.	95	95	98
West Va. Utilities, 7% pf.—50	41	43	45
Western Pwr., 7% pf.	k 98½	96	99
Western Pwr., com.—no par	m 80	n 34	n102
Western States Gas & Elec., 7% pf.	k 91	....	....
Western States Gas & Elec., com.	k 18	....	....
Westinghouse El. & Mfg., com—50	k 70½	66	79½
Weston Elec. Instrument, Class. A	k 30	27½	31½
Weston Elec. Instrument, com.	k 17	15½	19
Wheeling Elec., pf.	91	91	93½
Wis.-Minn. Lt. & Pwr., 7% pf.	m 90	....	....
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	k 75½	74½	80
Worthington Pump, pf. B	k 55	53½	65
Worthington Pump. com.	k 28½	26½	44½
YADKIN RIVER PWR., 7% pf.	l104½	102	105
Yale & Towne, com.—25	k 62½	60½	64½
BONDS			
ABITIBI PWR., & PAPER	6s	1940	k101½	....	....
Adir. Elec. Pwr.	5s	1962	k100½	....	....
Adir. Pwr. & Lt.	6s	1950	k105½	....	....
Adir. Pwr. & Lt.	5s	1930	97	97	99
Ala. Pwr.	5s	1946	99½	99	100½
Ala. Pwr.	5s	1951	97½	97	99½
Ala. Pwr.	6s	1951	104½	104½	105½
Ala. Trac., Lt. & Pwr.	5s	1962	m111	112	124
Aluminum Co. of Amer.	7s	1933	k107	106½	107½
Amer. Bosch Magneto	8s	1936	m105	2	....
Amer. Gas & Elec.	5s	2007	92	92	93½
Amer. Gas & Elec.	6s	2014	k 99½	98	100
Amer. Pwr. & Lt.	6s	2016	k 97½	96	98
Amer. Pub. Serv.	6s	1942	99½	98½	100½
Amer. Wtr. Wks. & Elec.	5s	1934	k 97	....	....
Amer. Wtr. Wks. & Elec.	6s	1975	k 93½	93	94½
Anaconda Copper	6s	1929	k102½	102½	103½
Anaconda Copper	6s	1953	k103½	....	....
Anaconda Copper	7s	1938	k104½	....	....
Appalachian Pwr.	5s	1941	k 99½	....	....
Appalachian Pwr.	6s	2024	94	93½	95
Appalachian Pwr.	7s	1936	106	105	106½
Arizona Pwr.	6s	1933	100½	99½	101
Arizona Pwr.	6s	1947	96	95½	97
Ark. Central Pwr.	6s	1948	102½	102	103½
Ark. Lt. & Pwr.	6s	1945	k104½	....	....
Ark. Lt. & Pwr.	6s	1954	k100½	....	....
Assoc. Gas & Elec.	6s	1965	k 93½	92½	94½
Assoc. Gas & Elec.	6½s	1954	k100½	....	....
BERLIN CITY ELEC.	6½s	1928	k 97½	97½	99½
Berlin City Elec.	6½s	1929	k 97½	97½	98½
Binghamtpn Lt., Ht. & Pwr.	5s	1946	k 99	....	....
Birmingham Elec.	6s	1954	103½	102½	104
Birmingham Ry., L. & P.	4½s	1954	91½	88	92½
Broad River Pwr.	6½s	1934	100	100	102
Brooklyn Edison	5s	1949	k103½	....	....
Brooklyn Edison	6s	1930	105	103½	106½
Buffalo Gen. Elec. 1st	5s	1939	102	101½	102½
Buffalo G. E., 1st & Ref.	5s	1939	101½	101½	102½
Buffalo G. E.	5s	1956	k101	100½	101½
Burlington Ry. & Lt.	5s	1932	98½	96	97½
Butte Elec. & Pwr.	5s	1951	k100½	....	....
CALIF. ELEC. GEN.	5s	1948	k100½	....	....
Calif. Gas & Elec.	5s	1937	100½	100½	101½
Calumet Gas & Elec.	5½s	1960	98½	97½	99
Canadian Lt. & Pwr.	5s	1949	62	56	64
Canton Elec.	5s	1937	100½	100	101
Carolina Pwr. & Lt.	5s	1938	101	100½	101½
Carolina Pwr. & Lt.	6s	1953	104½	104½	105½
Cedar Rap. Mfg. & Pwr.	5s	1953	100	99½	100½
Central Ark. Ry. & Lt.	5s	1928	99½	99	100½
Central Ga. Pwr.	5s	1938	96	95	96½
Central Ill. Lt.	5s	1943	k 98½	....	....
Central Ill. Pub. Serv.	5s	1952	92½	92	93½
Central Ill. Pub. Serv.	5½s	1950	96½	96	97½
Central Ill. Pub. Serv.	6s	1944	99½	99	101½
Central Ind. Pwr.	6s	1947	98½	98	99½
Central Ia. Pwr. & Lt.	6s	1944	100	99½	101
Central Maine Power	5s	1939	98½	98½	100
Central N. Y. Gas & El.	5s	1941	k 98	....	....
Central Pwr. & Lt.	6s	1946	k101½	....	....
Central Pwr. & Lt.	6½s	1952	k104½	....	....
Central States Elec.	6s	1945	96½	96	98½
Chattanooga Ry. & Lt.	5s	1956	88	81	90
Cincinnati Gas & Elec.	5s	1956	102	102	103½
Cincinnati Gas & Elec.	5½s	1961	104½	102½	104½
Cities Service	6s	1966	k 92½	92½	94
Cities Service	7sB	1966	k187	....	....
Cities Service	7sC	1966	k130½	125½	131
Cities Service	7sD	1966	k104	101½	104½
Cities Service	7sE	1966	k109½	....	....
Cities Service Pwr. & Lt.	6s	1944	k 95½	93½	95½
City L. & T., Sedalia, Mo	5s	1952	84½	83	85½
Cleveland Elec. Illum.	5s	1939	102½	102½	103½
Cleveland Elec. Illum.	5s	1954	k103	....	....
Cleveland Elec. Illum.	7s	1941	111	110	112
Colorado Pwr.	5s	1953	97½	95½	97½
Columbia Gas & Elec.	5s	1927	k100½	....	....
Columbia Ry., Gas & El.	5s	1936	93	92½	95
Columbus, Dela. & Marion Elec.	5s	1937	85½	83½	86
Columbus, Dela. & Marion Elec.	6s	1937	94½	93½	96
Columbus Elec. & Pwr.	6s	1947	k102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940	k 98	....	....
Columbus Ry., Pwr. & Lt.	6s	1941	k104	....	....
Commonwealth Edison	5s	1943	k102½	....	....
Commonwealth Edison	5s	1953	100	99½	101
Commonwealth Edison	5s	1954	k100	....	....
Commonwealth Pwr.	5s	1939	k 91½	....	....
Commonwealth Pwr.	6s	1972	k 96	....	....
Commonwealth Pwr.	6s	1947	k103½	....	....
Community Pwr. & Lt.	6s	1950	99½	98	99½
Conn. Ry. & Ltg.	4½s	1951	90½	90½	92
Consol. Cities Lt., Pwr. & Trac.	5s	1962	80	80	82½
Consol. Elec.	5s	1955	97½	98	99
Consol. Gas of N. Y.	5½s	1945	k105½	....	....
Con. Gas. Elec. Lt. & Pwr. of Balti.	4½s	1935	c 97½	95½	98
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	6s	1949	c106½	105½	107
Con. Gas. Elec. Lt. & Pwr. of Balti.	5s	1965	c100½	100½	100½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	5½s	1952	c105½	104½	105½
Con. Gas. Elec. Lt. & Pwr. (notes)	6½s	1951	m109½	109½	109½
Consumers Elec. L. & P.	5s	1936	k 97	....	....
Consumers Pwr.	5s	1936	k100½	....	....
Consumers Pwr.	5s	1952	k100	....	....
Consumers Pwr.	5½s	1954	k103½	....	....
Continental Gas & Elec.	5s	1927	k100	....	....
Continental Gas & Elec.	6s	1947	k101½	....	....
Continental Gas & Elec.	6½s	1964	k 98½	....	....
Continental Gas & Elec.	7s	1954	k105½	....	....
Cumberland Cty. Pw. & Lt.	5s	1942	95½	94	96½
DALLAS PWR. & LT.	6s	1949	104½	104	105
Dayton Ltg.	5s	1937	100	100	101
Dayton Pwr. & Lt.	5s	1941	k 101	....	....
Defiance Gas & Elec.	5s	1942	98½	98	99
Denver Gas & Elec.	5s	1949	98½	98	100
Denver Gas & Elec. Lt.	5s	1951	k 95½	....	....
Des Moines Elec.	5s	1938	100	99	100½
Detroit Edison	5s	1933	101½	101	102½
Detroit Edison	5s	1940	102	100½	102½
Detroit Edison	5s	1949	100½	100	102½
Detroit Edison	5s	1955	k100½	....	....
Detroit Edison	6s	1932	125	125	135
Detroit Edison	6s	1940	107½	107½	108½
Detroit Edison	7s	1928	m134	....	....
Detroit Edison	7s	1929	m130	130	130
Detroit Edison	7s	1930	m125½	125½	138½
Dominion Pwr. & Trans	5s	1932	96½	95	97
Driver-Harris	8s	1931	97	95	98½
Dubuque Elec.	6s	1942	101½	102	103½
Duke-Price Pwr.	6s	1949	103½	102	104
Duquesne Lt.	6s	1949	k106	....	....
Duquesne Lt.	5½s	1949	105½	105	106½
Durham Pub. Serv.	7s	1949	100½	99	101½
EAST PENN. ELEC.	6s	1953	104½	105	106
East Oregon Lt. & Pwr.	6s	1929	100	100	101
East. Tex. Elec.	5s	1942	k 96	....	....
Economy Lt. & Pwr.	5s	1956	98½	99	100
Edison Elec. Illum. of Boston (notes)	4½s	1928	99½	99½	100½
Edison Elec. Illum. of Bklyn.	4s	1939	93½	93	99½
Edison El. Illum. (N.Y.)	5s	1995	104½	103	105
El Paso Elec.	5s	1932	k102	....	....
El Paso Elec.	5s	1950	96	95	96½
El. Pwr. Corp. (Germany)	6½s	1950	k 88½	....	....
Elec. Refrigeration	6s	1936	k102½	100½	107
Elmira Wtr., Lt. & R.R.	5s	1956	96	96	97
Empire Dist. Elec.	5s	1949	93½	92	93½
Erie Ltg.	5s	1967	99	99	100½
Evansville G. & El. Lt.	5s	1932	99	99	100
FEDERAL LT. & TRAC.	5s	1942	k 94	....	....
Federal Lt. & Trac.	6s	1942	103	101½	104½
Federal Lt. & Trac.	6s	1954	94½	93	96
Florida Power & Light	5s	1954	k 93½	93	94
Florida Publ. Service	6s	1955	97	97	99
Florida Public Service	6½s	1949	99	100	103
Ft. Smith Lt. & Trac.	5s	1936	k 79	....	....
Ft. Worth Pwr. & Lt.	5s	1931	100	99	100½
GALVESTON ELEC.	5s	1940	90	89	92
General Elec.	3½s	1942	87½	87	88½
Georgia Carolina Pwr.	5s	1952	88½	87	89½
Ga. Lt., Pwr. & Rys.	5s	1941	89½	88	92
Ga. Ry. & Elec.	5s	1932	99½	98½	100½
Ga. Ry. & Elec.	5s	1949	95½	95	97
Ga. Ry. & Pwr.	5s	1954	96½	96	99
Ga. Ry. & Pwr.	6s	1947	k104	....	....
Ga. Ry. & Pwr.	7s	1941	k105	....	....
German Gen. Elec.	6½s	1940	k 96½	94	99½
German Gen. Elec.	7s	1945	k 98½	....	....
Great Cons. Elec. Pwr. (Japan)	6½	1950	k 85½	85½	86
Great Cons. Elec. Pwr. (Japan)	7s	1944	k 91½	....	....
Great Falls Pwr.	5s	1940	104½	101½	104½
Great Northern Pwr.	5s	1935	99½	98½	100
Great Western Pwr.	5s	1946	k 99½	....	....
Great Western Pwr.	5½s	1955	99½	99	101
Great Western Pwr.	6s	1949	102½	102	103½
Great Western Pwr.	6s	1952	k102½	....	....
HAMBURG ELEC.	7s	1935	k 95½	94	96½
Havana Elec. R., Lt. & P.	5s	1954	94½	92½	94½
Holtwood Pwr.	6s	1954	104½	100	104½
Houston Ltg. & Pwr.	5s	1931	100	99	101
Houston Ltg. & Pwr.	5s	1953	96½	90½	95½
Houston Ltg. & Pwr.	5½s	1954	100½	99½	102½
Hydraulic Pwr.	5s	1951	101½	101½	102
Hydraulic Pwr.	5s	1950	101½	101½	103
IDAHO PWR.	5s	1947	97½	96	98½
Ill. Elec. Pwr.	6s	1943	103	102	103½
Ill. Pwr.	5s	1933	k 94	....	....
Ill. Pwr.	6s	1944	k 98	....	....
Ill. Pwr. & Lt.	5½s	1954	97½	97½	99
Ill. Pwr. & Lt.	6s	1953	102	100½	102½
Ill. Pwr. & Lt.	7s	1953	102½	102½	103½
Ind. Elec.	6s	1947	98½	98	100
Ind. Gen. Serv.	5s	1948	97½	96½	98½
Ind. Lighting	4s	1958	83½	82½	84
Indiana & Mich. Elec.	5s	1955	97½	96	98½
Indiana & Mich. Elec.	5s	1957	99½	97½	100
Ind. Pwr.	7½s	1941	m105½	m104	m106
Ind. Service	5s	1950	92	91½	93
Ind. Service	6s	2020	87½	86½	88½
Ingersoll-Rand	5s	1935	100	....	....
Interstate Elec.	6s	1933	97½	94	98½
Interstate Pwr.	6s	1944	k 99	....	....
Interstate Pwr.	7s	1934	k100½	....	....
Interstate Pub. Serv.	6s	1948	99½	98	99½
Iowa Ry. & Lt.	5s	1932	98½	97½	99½
Iowa Southern Utilities	5½s	1950	94	94	96
JERSEY CENT. PWR. & LT.	5½s	1945	96½	95	98
KANSAS CITY PWR. & LT.	5s	1952	k101½	....	....
Kansas Elec. Pwr.	6s	1937	k101	....	....
Kansas Elec. Pwr.	6s	1943	101	99½	101½
Kansas Gas & Elec.	6s	1952	k104½	....	....
Kansas Gas & Elec.	6s	2022	93	92½	93

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. lTuesday, March 23. mBid, low, high, Wednesday, March 24. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday March 20	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec....	6s	1949	100⅛	99½ 101⅛
Kentucky Utilities.....	6s	1949	101	99½ 101½
Kings Cty. Elec. L. & P..	5s	1937	103	102 103
Kings Cty. Elec. L. & P..	6s	1997	121½	120½ 123
Kings County Ltg.....	5s	1954	98½	98½ 100⅛
Kings County Ltg.....	6½s	1954	108½	106 108½
Knoxville Ry. & Lt.....	5s	1946	96½	95½ 97
LACLEDE GAS LT.....	5s	1934	k101½	....
Laclede Gas Lt.....	5½s	1953	k104½	....
Laurentian Pwr.....	6s	1936	100	100 101
Laurentide Pwr.....	5s	1946	100	100 102
Lehigh Pwr. Sec.....	6s	2026	k 95	93 95½
Lincoln Gas & Elec.....	5s	1941	93½	92½ 94½
Long Island Ltg.....	5s	1936	k100½	....
Long Island Ltg.....	6s	1954	100½	100 101½
Long Island Ltg.....	6s	1948	105½	104½ 106
Los Angeles Gas & Elec..	5s	1939	k100½	....
Los Angeles Gas & Elec..	5½s	1943	100	99 100⅛
Los Angeles Gas & Elec..	5½s	1947	k100½	....
Los Angeles Gas & Elec..	5½s	1949	100	99 101
Los Angeles Gas & Elec..	6s	1942	104½	102½ 104
Louisiana Pwr.....	6s	1944	99½	98½ 100
Louisville Gas & Elec....	5s	1952	k 99½	....
Louisville Gas & Elec....	5½s	1954	103½	102 103⅛
Lower Austrian Hydro El.	6½s	1944	k 86½	....
Luzerne Cty. Gas & El...	5s	1948	98	97½ 99½
Luzerne Cty. Gas & El...	7s	1944	104½	103½ 105½
Luzerne Cty. Gas & El...	6s	1954	103½	102 104
MADISON RIV. PWR..	5s	1935	100½	100 101
Manila Elec.....	7s	1942	k110½	....
Manila Elec. Ry. & Ltg..	5s	1953	k 90½	....
Manitoba Pwr.....	7s	1941	k105½	103½ 105⅛
Memphis Pwr. & Lt.....	5s	1948	99½	99 100½
Metropolitan Edison.....	6s	1952	k107½	....
Metropolitan Edison.....	5s	1953	99½	96½ 99⅛
Metropolitan Pwr.....	6s	1953	103½	102½ 104½
Michigan Lt.....	5s	1946	99½	99 100½
Michigan No. Pwr.....	5s	1941	98½	97 99
Milwaukee El. Ry. & Lt..	5s	1926	m 99½	99½ 99½
Milwaukee El. Ry. & Lt..	4½s	1931	98	97 99
Milwaukee El. Ry. & Lt..	5s	1951	99½	98½ 100
Milwaukee El. Ry. & Lt..	5s	1961	94	90½ 94½
Milwaukee El. Ry. & Lt..	6s	1953	k104	....
Minn. Pwr. & Lt.....	5s	1955	96½	95½ 97
Minn. Pwr. & Lt.....	6s	1950	105	104 105½
Miss. Power.....	5s	1955	93½	92 94
Miss. River Pwr.....	5s	1951	k 99	....
Miss. River Pwr.....	7s	1935	101½	102 103
Mo. Edison Elec.....	5s	1927	m100½	100½ 100½
Mobile Elec.....	5s	1946	k 97½	....
Monongahela W. Pa. Pub. Service.....	5½s	1953	96½	95 97½
Montana Pwr.....	5s	1943	k101½	....
Montgomcry Lt. & W.P..	5s	1943	m 93	n 86½ n 93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97 98½
Montreal Lt., Ht. & Pwr.	5s	1933	99½	99½ 101
Montreal Pub. Serv.....	5s	1942	94½	94 95½
Mountain States Pwr.....	6s	1938	100	98½ 100
NASHVILLE RY. & LT.	5s	1953	98	96½ 98½
Nashville Ry. & Lt.....	5s	1958	92½	90½ 92½
Nassau Lt. & Pwr.....	5s	1927	99½	98½ 100½
Nassau & Suffolk Ltg....	5s	1945	91	89½ 91½
National Elec. Power.....	6s	1945	92½	92½ 94
National Pwr. & Lt.....	7s	1972	k103	....
National Pub. Serv.....	6½s	1955	96½	94½ 97
Nebraska Pwr.....	5s	1949	99½	99 100½
Nebraska Pwr.....	6s	2022	97	94½ 96½
Nevada-Calif. Elec.....	6s	1946	k 99½	....
Nevada-Calif. Elec.....	6s	1950	99½	98½ 100
New Brunswick Pwr.....	5s	1937	83½	81½ 85
New England Pwr.....	5s	1951	104	100½ 104½
New Jersey Pwr. & Lt....	5s	1936	98½	96½ 99
New Orleans Pub. Serv...	4½s	1935	88	87 88½
New Orleans Pub. Serv...	5s	1952	k 93½	90½ 94½
New Orleans Pub. Serv...	5s	1955	92½	90½ 94½
New Orleans Pub. Serv...	6s	1949	92	90 92½
N.Y. & Queens El. L.&P..	5s	1930	101½	100½ 103½
N.Y. & Westchester Ltg..	4s	2004	81½	79½ 81½
N.Y. & Westchester Ltg..	5s	1954	98	97½ 98½
New York Edison.....	6½s	1941	116	115 116½
New York Edison.....	5s	1944	k102½	....
N.Y. Gas & El. L. H.&P.	5s	1948	k104	104 105
N.Y. Gas & El. L. H.&P.	4s	1949	90	89½ 90½
N.Y. State Gas & Elec...	5½s	1962	100½	100 101
Newport News & Hampton Ry., Gas & Elec....	5s	1944	90½	89½ 91
Niagara Falls Pwr.....	5s	1932	k102	....
Niagara Falls Pwr.....	6s	1932	105½	104½ 106½
Niagara Falls Pwr.....	6s	1950	105½	105 106½
Niagara, Lock. & Ont. Pwr.	5s	1954	m 98½	n104½ n110
Niagara, Lock. & Ont. Pwr.	5s	1955	k100½	....
Niagara, Lock. & Ont. Pwr.	6s	1958	m106	....
Norfolk Ry. & Lt.....	6s	1949	95½	94 96½
No. Amer. Edison.....	6s	1952	k103½	....
No. Amer. Edison.....	6½s	1948	k105½	....
No. Amer. Lt. & Pwr.....	7s	1954	99½	99 100½
North Caro. Pub. Serv...	5s	1934	k 92½	....
North Caro. Pub. Serv...	6s	1954	95	94½ 96
North Caro. Pub. Serv...	6½s	1944	99	98 100½
North Shore Elec.....	5s	1940	100	98½ 100½
No. Calif. Pwr.....	5s	1948	100½	99½ 101½
No. Ind. Gas & Elec.....	5s	1929	99	99 100
No. Ind. Gas & Elec.....	6s	1952	104½	102½ 105
Northern N. Y. Utilities..	5½s	1949	101	100 101½
No. Ohio Pwr.....	7s	1935	k 94	....
No. Ohio Trac. & Lt.....	4s	1933	88	87 89
No. Ohio Trac. & Lt.....	5s	1956	84	84 86
No. Ohio Trac. & Lt.....	6s	1926	99	99 100
No. Ohio Trac. & Lt.....	6s	1947	94	92½ 95½
No. Ontario Lt. & Pwr...	6s	1931	m100	n 95½ n100½
No. States Pwr.....	6½s	1933	k113½	108 132
No. States Pwr. (notes)....	6½s	1933	k104	102½ 104
No. States Pwr.....	6s	1948	k103	....
No. States Pwr.....	6s	1941	105½	105½ 106½
No. States Pwr.....	5s	1941	k 99½	....
No. Tex. Elec.....	5s	1940	72	72 75
Northwestern Elec.....	6s	1935	102½	102 103½
Northwestern Pub. Serv..	6½s	1948	101½	99½ 101½
Nova Scotia Tr. & Pwr...	5s	1946	88	88 90
OHIO PWR.....	5s	1952	95	94 95½
Ohio Pwr.....	6s	1953	104	103½ 104½
Ohio Pwr.....	6s	2024	96½	95½ 96½
Ohio Pwr.....	7s	1951	k106	....
Ohio Pub. Serv.....	5s	1954	94½	92½ 94½
Ohio Pub-Serv.....	6s	1953	101½	101 102½
Ohio Pub. Serv.....	7½s	1946	112½	112½ 113½
Ohio Pub. Serv.....	7s	1947	111½	110½ 111½
Ohio River Edison.....	6s	1948	k102½	....
Okla. Gas & Elec.....	5s	1950	93½	93 94½
Okla. Gas & Elec.....	6s	1940	k 96½	....
Ontario Pwr. of Niagara Falls.....	5s	1943	99½	99½ 101
Ontario Transmission.....	5s	1945	99½	99½ 99½
Ozark Pwr. & Wtr.....	5s	1952	80½	77 81½
PACIFIC COAST PWR..	5s	1940	99½	99 100½
Pacific Gas & Elec.....	5s	1942	k 99½	....
Pacific Gas & Elec.....	5s	1955	m 93½	n 94 n 95½
Pacific Gas & Elec.....	5½s	1952	k103	....
Pacific Gas & Elec.....	6s	1941	k107½	....
Pacific Lt. & Pwr.....	5s	1942	k101	....
Pacific Lt. & Pwr.....	5s	1951	100½	100 101½
Pacific Pwr. & Lt.....	5s	1930	100	99½ 100⅛
Pacific Pwr. & Lt.....	5s	1953	m 96½	....
Parr Shoals Pwr.....	5s	1952	97	95 98½
Paterson & Passaic G.&E.	5s	1949	100½	100 100⅛
Penn Central Lt. & Pwr...	6s	1953	103½	102½ 105
Penn Edison.....	5s	1946	98	96½ 98½
Penn. Elec.....	6s	1955	98½	92 99
Penn Elec.....	6½s	1954	99½	97 100½
Penn.-Ohio Edison.....	6s	1950	k101	98½ 106
Penn Ohio Elec.....	6½s	1938	107	105 107
Penn Ohio Pwr. & Lt.....	5½s	1954	k 99½	....
Penn Ohio Pwr. & Lt.....	6s	1939	97½	97 98½
Penn Pwr. & Lt.....	5s	1952	k 98½	97½ 99
Penn Pwr. & Lt.....	5s	1953	k 98½	97½ 99
Penn Pwr. & Lt.....	6s	1953	105½	105 106
Penn Pwr. & Lt.....	7s	1951	105½	105½ 106½
Penn Pub. Serv.....	5s	1954	97½	96 98½
Penn Pub. Serv.....	6s	1947	104	103 105
Penn Wtr. & Pwr.....	5s	1940	101½	101½ 102½
Penn Wtr. & Pwr.....	5½s	1953	103½	102½ 103½
Phila. Co.....	6s	1944	k104½	....
Phila. Co.....	5½s	1938	k100	....
Phila. Co.....	5s	1951	98½	97½ 99½
Phila. Co.....	5s	1949	m104½	103½ 104½
Phila. Elec.....	5s	1966	c103½	102½ 104½
Phila. Elec.....	4s	1966	m 85½	84 85½
Phila. Elec.....	5s	1960	c102½	102 103
Phila. Elec.....	6s	1941	c108	107½ 108½
Phila. Elec.....	5½s	1947	c107½	103½ 107½
Phila. Elec.....	5½s	1953	c107½	106 107½
Phila. Elec. Pwr.....	5½s	1972	k100½	100½ 101
Portland Elec. Pwr.....	6s	1947	k102	....
Portland Gen. Elec.....	5s	1935	100½	99½ 100½
Portland Ry., Lt. & Pwr..	5s	1942	90½	88½ 93
Portland Ry., Lt. & Pwr..	6s	1947	101½	99 102½
Portland Ry., Lt. & Pwr..	7½s	1946	k108½	....
Potomac Edison.....	6s	1949	100	99 100½
Potomac Edison.....	6½s	1948	103½	103 104
Potomac Elec. Pwr.....	5s	1929	j100	....
Potomac Elec. Pwr.....	5s	1936	j 99½	....
Potomac Elec. Pwr.....	6s	1953	j106½	....
Potomac Elec. Pwr.....	7s	1941	j107½	....
Power Corp. of N. Y.....	6s	1942	100½	101 101½
Power Corp. of N. Y.....	6½s	1942	104½	104 105½
Power Securities.....	6s	1949	k 77	....
Pub. Lt. & Pwr.....	5s	1945	69	68 73
Pub. Serv. Co. of Colo...	5½s	1954	95½	95 96½
Pub. Serv. Co. of Colo...	6s	1953	100½	100 101½
Pub. Serv. Co. of Colo...	7s	1933	100½	101½ 102½
Pub. Serv. Corp. of N.J..	5s	1959	k104½	....
Pub. Serv. Corp. of N.J..	6s	1944	k102	....
Pub. Serv. Co. of No. Ill..	5s	1956	98½	98 99½
Pub. Serv. Co. of No. Ill..	5½s	1962	103½	103½ 105
Pub. Serv. Co. of No. Ill..	5½s	1964	103½	103½ 105½
Pub. Serv. Co. of Okla...	6s	1949	100½	98½ 100½
Pub. Serv. Elec. & Gas...	5½s	1959	k105	....
Pub. Serv. Elec. & Gas...	5½s	1964	k105	....
Pub. Util. Evansville, (Ind.)	6s	1929	k100	....
Puget Sound Pwr.....	5s	1933	100½	99 100½
Puget Sound Pwr. & Lt...	5½s	1949	k 99	....
QUEBEC PWR.....	6s	1953	102½	101½ 102½
Queensborough Gas & E..	5s	1952	99½	99½ 100½
Queensborough Gas & E..	6s	1953	104½	104 105½
RHINE-WESTPHALIA ELECTRIC PWR....	7s	1950	k 94½	93½ 96
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	94	93 94½
Robbins & Myers.....	7s	1952	67½	60 68½
Rochester Gas & Elec....	5½s	1948	106	105½ 106
Rochester Gas & Elec....	7s	1946	112½	112½ 114
Rochester Ry. & Lt.....	5s	1954	m100½	100½ 101½
Rockford Elec.....	5s	1939	100½	99½ 100½
ST. MAURICE PWR...	6½s	1953	108½	108 109½
St. Paul Gas Lt.....	5s	1944	100½	100½ 101½
St. Paul Gas Lt.....	5½s	1954	101½	101 102½
St. Joseph Ry., Lt., H.&P.	5s	1937	94	91½ 97
Salt River Valley Wtr....	6s	1938	k100	....
Salmon River Pwr.....	5s	1952	100½	100½ 101½
San Antonio Gas & Elec..	5s	1949	96½	96 97½
San Antonio Pub. Serv....	6s	1952	103	101½ 103½
San Diego Cons. G.&E....	5s	1939	k100½	....
San Diego Cons.G.&E....	6s	1939	101½	101 102½
San Joaquin Lt. & Pwr...	5s	1945	99½	98½ 100
San Joaquin Lt. & Pwr...	6s	1950	102½	103 104½
San Joaquin Lt. & Pwr...	6s	1952	102½	99½ 103½
San Joaquin Lt. & Pwr...	6s	1954	101½	100½ 102½
Sauda Falls.....	5s	1955	94½	94½ 96
Savannah Elec. & Pwr....	7½s	1941	k104½	....
Saxon Pub. Wks. (Germany).....	7s	1945	k 95½	....
Scranton Electric.....	5s	1937	102	101½ 102½
Seattle Elec.....	5s	1930	101	100½ 101½
Seattle Elec.....	5s	1929	99½	99½ 100½
Seattle Elec.....	5s	1939	93½	92½ 94½
Seattle Ltg.....	5s	1949	91½	90½ 94
Shawinigan Wtr. & Pwr..	5s	1934	101½	100 101½
Shawinigan Wtr. & Pwr..	5½s	1950	104	103½ 104½
Shawinigan Wtr. & Pwr..	6s	1950	104½	104½ 105½
Sheboygan Elec.....	5s	1946	95½	94½ 96½
Siemens & Halske.....	7s	1928	99	96½ 99½
Siemens & Halske.....	7s	1935	k 96½	93 98
Sierra & San Fran. Pwr...	5s	1949	k 94	....
Sierra & San Fran. Pwr...	6s	1949	k 90	90 91
Sioux City Gas & Elec....	6s	1947	102	101½ 102½
Sioux City Gas & Elec....	6s	1949	102	102 103½
So. Caro. Gas & Elec....	6s	1942	78	78 83
So. Caro. Gas & Elec....	6s	1932	65	70 75
Southeast Pwr. & Lt. (ex-warranto).....	6s	2025	k 91½	89 93
So. Cal. Edison.....	5s	1939	k100½	....
So. Cal. Edison.....	5s	1944	98½	98 99½
So. Cal. Edison.....	5½s	1944	103½	103 104½
So. Cal. Edison.....	6s	1943	103	102 104
So. Cal. Edison.....	6s	1944	k105½	....
So. Cities Utilities.....	8s	1931	99	99 102
Southern Colo. Power....	6s	1947	98½	97½ 99½
So. Ind. Gas & Elec.....	6s	1947	k 97½	....
Southern Pwr.....	5s	1930	100½	100 101
So. Public Utilities.....	5s	1943	100½	100 101½
So. Sierras Pwr.....	6s	1936	k103½	....
So. Utilities.....	6s	1933	m102	n 97½ n102½
So. Wisconsin Pwr.....	5s	1938	92	91 93
Southwestern Gas & E....	5s	1932	97	97 98½
Southwestern Gas & E....	6s	1957	98½	97½ 99½
Southwestern Lt. & Pwr..	6s	1937	98½	98 99½
Southwestern Power.....	6s	1944	96½	96½ 98
Southwestern Pwr. & Lt..	5s	1943	94½	94 96
Southwestern Pwr. & Lt..	6s	2022	94½	94 96
Southwestern Pub. Serv..	6s	1945	95	94 96
Southwestern Utilities....	8s	1936	92	92½ 96
Springfield Ry. & Lt.....	5s	1926	99½	99½ 100½
Standard Elec. of Cal....	5s	1939	100	99½ 101
Standard Gas & Elec.....	6s	1935	k 99½	....
Staten Island Edison.....	6½s	1953	105½	106 107½
Superior Water, Lt. & Pwr.	4s	1931	94½	94½ 95½
Syracuse Ltg.....	5s	1951	100½	100 100½
Syracuse Ltg.....	5½s	1954	103½	103½ 104½
TAMPA ELEC.....	5s	1933	k 99	....
Tenn. Elec. Pwr.....	6s	1947	k105½	....
Tenn. Pwr.....	5s	1962	96½	96 97
Tex. Pwr. & Lt.....	5s	1937	98½	98½ 100
Tex. Pwr. & Lt.....	6s	2022	96½	95½ 97
Tide Water Pwr.....	6s	1942	101½	100 101½
Tide Water Pwr.....	7s	1937	101½	100 102½
Toho Elec. Pwr. (Japan)..	7s	1955	k 91½	....
Tokyo Elec. (Japan).....	6s	1928	k 98½	....
Toledo Edison.....	5s	1947	100	100 100½
Toledo Edison.....	7s	1941	k108½	....
Toledo Gas, Elec. & Htg.	5s	1935	100	98 100½
Toledo Tr., L.&P. (notes)	5½s	1930	98½	98 99
Topeka Edison.....	5s	1930	99	99 100
Topeka Ry. & Lt.....	5s	1933	94½	94½ 96½
Trenton Gas & Elec.....	5s	1949	100½	100½ 101
Tri-City Ry. & Lt.....	5s	1930	k 98½	....
Twin State Gas & Elec...	5s	1953	95½	95 96½
Twin State Gas & Elec...	5½s	1945	98½	98 99
Tyrol Hydro-Elec. Pwr...	7½s	1955	97	97 97½
UJIGAWA ELEC PWR.	7s	1945	92½	92 94
Union Elec. Lt. & Pwr...	5s	1932	101	100½ 102½
Union Elec. Lt. & Pwr...	5s	1933	k100½	....
Union Elec. Lt. & Pwr...	5s	1954	99	99½ 101
Union Elec. Lt. & Pwr...	5½s	1954	101½	100½ 102½
United Elec. of N.J.....	4s	1949	87½	87½ 89
United Elec. Lt. & Pwr...	4½s	1929	98	98 99½
United Gas & Elec.....	6s	1945	m101½	n 96 n101
United Lt. & Pwr. (notes)	5½s	1928	99½	99 100½
United Lt. & Pwr.....	5½s	1959	95½	96 97½
United Lt. & Pwr.....	6½s	1974	95½	95½ 98½
United Lt. & Rys.....	5s	1932	k 96½	....
United Lt. & Rys.....	6s	1926	99½	100 101½
United Lt. & Rys.....	6s	1952	100½	99 101½
United Lt. & Rys.....	6s	1973	89	89½ 92
United Pwr. & Lt.....	6s	1944	102	102 103½
United Water, G. & E....	5s	1941	94½	94 95
Utah Lt. & Trac.....	5s	1944	k 88½	....
Utah Pwr. & Lt.....	5s	1944	k 96½	....
Utah Pwr. & Lt.....	6s	1944	103	102½ 104½
Utah Pwr. & Lt.....	6s	2022	93	88½ 94½
Utica Elec. Lt. & Pwr....	5s	1950	101½	100½ 101½
Utica Gas & Elec.....	5s	1957	101½	100½ 102½
Utica Gas & Elec.....	5½s	1949	104	103½ 104½
VERMONT HYDRO - ELEC.....	6s	1929	100½	100 101
Vicksburg Ry. & Trac....	5s	1932	94½	93½ 93½
Virginian Pwr.....	5s	1942	96	88 97
Virginian Pwr.....	6½s	1954	m103½	103 104½
Virginia Ry. & Pwr.....	5s	1943	98½	97½ 99
Virginia-Western Pwr....	6s	1953	102	101½ 102½
WAGNER EL. MFG....	7s	....	101½	100½ 101½
Washington Coast Util...	6s	1941	102½	102½ 103½
Washington Ry. & Elec...	4s	1951	j 81	....
Washington Ry. & Elec...	6s	1933	j 103	....
Washington Wtr. Pwr....	5s	1939	101½	101½ 102½
West Penn Pwr.....	5s	1963	k100½	....
West Penn Pwr.....	5s	1946	100	99½ 102
West Penn Pwr.....	5½s	1953	105½	104½ 106
West Penn Pwr.....	7s	1946	105½	105½ 108½
W. Va. Lt., Ht. & Pwr...	6s	1929	102	101 101
West Virginia Utilities....	6s	1935	97½	95½ 97½
W. Va. Water & Elec....	6½s	1942	103½	102½ 104
Westchester Ltg.....	5s	1950	101½	102½ 103½
Western Elec.....	5s	1944	k101½	....
Western N. Y. Utilities...	5s	1946	97	96½ 98
Western Pwr.....	6½s	1954	100	100 102
Western Pub. Service....	6s	1950	98½	98 99½
West States Gas & Elec..	5s	1941	99	98½ 99½
West States G.&E. (notes)	6s	1937	94½	94½ 96
West States Gas & Elec..	6s	1947	k100	....
West United Gas & El...	5s	1950	102	101½ 102½
West United Gas & El....	6s	1950	m102	n100 n102
Westphalia Un. Elec. Pwr	6½s	1950	m 98½	....
Westinghouse El. & Mfg.	7s	1931	k105½	....
Wheeling Elec.....	5s	1941	99	99 100
Wichita R. R. & Lt.....	5s	1932	85	83 88
Winnipeg Elec.....	6s	1954	96½	96 97½
Wisconsin Elec. Pwr.....	5s	1954	99	98½ 99½
Wisconsin Gas & Elec.....	5s	1952	k 99½	....
Wis.-Minn. Lt. & Pwr.....	5s	1944	k 97	....
Wisconsin Pwr., Lt. & Ht	5s	1946	93½	92 94½
Wisconsin Pub. Service....	6s	1952	101½	101 102½
Wis. Ry., Lt. & Pwr.....	5s	1933	95½	94½ 96½
Wis. River Pwr.....	5s	1941	93½	92½ 94
Wolverine Pwr.....	7s	1943	101	100 101½
YADKIN RIVER PR..	5s	1941	k100½	....
Yarmouth Lt. & Pwr.....	5s	1937	83	83 87
Yarmouth Lt & Pwr.....	8s	1951	101	99 102

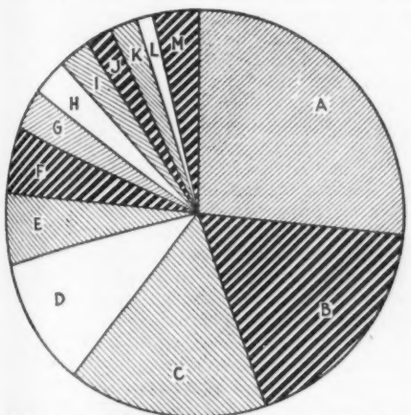
Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, March 23. *l*Bid, low, high, Wednesday, March 24, *m*Latest quotations available. *n*1925.

Manufacturing and Markets

Appliance Market of Western States

High Percentage of Wired Homes Is Chief Contributing Factor to the Highly Intensified Market

BECAUSE of a long period of intensive electrical development the eleven Western states offer a better market for domestic electrical appliances than any other section of the United States. Surveys made by the McGraw-Hill Publishing Company, Inc., show that the Western residential consumer spends half again as much on domestic electric labor-saving devices as the national average. A study of the field by the *Journal of Electricity* shows



A-Washing machines	$8,427,000	H-Percolators	$802,000
B-Vacuum cleaners	$4,537,000	I-660-Watt air heaters	$744,000
C-Ranges	$4,987,000	J-Toasters	$714,000
D-Refrigerators	$3,152,000	K-Waffle irons	$589,000
E-Lamps	$1,800,000	L-Fans	$310,000
F-Irons	$1,488,000	M-Miscellaneous	$1,550,000
G-Ironers	$ 900,000		

GRAPHIC PRESENTATION OF APPLIANCE MARKET

that the average annual expenditure for appliances in the West is $15.30 per residential consumer as against the national average of $10.88. It is estimated that during 1926 in excess of $31,000,000 will be spent in this section for appliances to electrify the Western home.

APPLIANCE PURCHASING BUDGET OF ELEVEN WESTERN STATES

(Totaling in 1926, $31,000,000)

	Per Cent	Value	Number	Per Cent of Consumers to Buy
Washers	27.1	$8,427,000	51,100	2.54
Cleaners	17.9	4,537,000	90,600	4.52
Ranges	16.1	4,987,000	24,900	1.25
Refrigerators	10.2	3,152,000	10,500	0.525
Lamps	5.8	1,800,000	6,000,000	3 per customer
Irons	4.8	1,488,000	248,000	12.35
Ironers	2.9	900,000	5,150	0.25
Percolators	2.6	802,000	100,000	5
660-watt air heaters	2.4	744,000	74,400	3.7
Toasters	2.3	714,000	119,000	5.94
Waffle irons	1.9	589,000	42,000	2.05
Fans	1	310,000	20,700	1.03
Miscellaneous	5	1,550,000	.....	....

Chief among the contributing factors for this highly intensified market is the high percentage of wired homes. The West in its entirety has 70 per cent of its homes wired as against 56 per cent for the nation as a whole. Individual states have a much higher average. Utah has 98 per cent of its homes wired, California 92 per cent and other states in proportion. The West has 14 per cent of all wired homes in the United States. A second reason for this highly intensified market is the exceedingly favorable rates for domestic consumers. A third reason is the large amount of energy that is used—with less than 8 per cent of the population of the United States the West uses 19.5 per cent of the electrical energy generated.

The four major items in the appliance budget for 1926 are washing machines, vacuum cleaners, ranges and electric refrigerators. The accompanying chart and table show the exact amount which will be spent for these appliances as well as others which go to make the modern home completely electrified.

A Constitution for the Code

Recommendations by a Sub-Committee of the N.E.L.A. Wiring Committee for an Interpretation of the Purposes of that Instrument

BY S. E. DOANE
Chairman of the Sub-Committee

THE National Electrical Code of the American Engineering Standards Committee is an endeavor to put certain fundamental principles into definite language for the wiremen. Analysis shows that there are only seven fundamental requirements in the whole code, but nowhere are these fundamental requirements definitely stated. It is the sub-committee's desire to add to the existing code these fundamentals and to express them in such a manner that a specific appreciation of the high intent of the code shall be rendered more general. The sub-committee consists of S. E. Doane, chairman; A. K. Baylor, H. G. Knoderer and V. H. Tousley.

The fundamentals of the code can be classified as follows:

I. Continuity of conductors.
II. Insulation:
  A. By dielectrics.
  B. By spacing.
III. Protection of insulation:
  A. Against mechanical injury.
  B. Against heat damage.
  C. Against dampness and chemical action.
IV. Protection against fire risk:
  A. By ample carrying capacity.
  B. By overload releases.
  C. By isolation from inflammable materials.
V. Protection against risk to human beings:
  A. General.
  B. Grounding.
VI. Identification of materials.
VII. Conformance to code.

It will be observed that all of these basic requirements fall into two general classes—first, political, administrative, economic, or, in the commonly expressed term, "business"; second, technical. The technical rules must fulfill two requirements—first, they must be sound in theory; second, they must be readily applicable.

In addition to the following analysis of these Underwriters' rules the committee plans to submit recommendations whereby it will be easier for our companies in the field to take part in the formulation of local ordinances applying to situations not previously covered by the code by putting at their disposal, first, a fundamental statement by which the suggestions for any new local ordinances can be tested, and, second, a means for ascertaining facts necessary for decision thereunder. We would suggest that we compose seven carefully worded statements outlining these seven basic requirements. These then should be offered for deliberation and editing to national associations such as the American Institute of Electrical Engineers.

To illustrate what we have in mind we have attempted to word a basic rule as follows:

I. Continuity of Conductors.

Conductors must furnish a path for current which shall be so free from flaw or blemish that the current shall flow therein with no more resistance at joints or connections than characterizes the wire of the circuit. Conductors must also be so joined or connected that they will not mechanically interrupt at a point of junction or connection under the usage to which this wire is ordinarily liable to be subjected.

The material and character of joints and connections must be such that they will not deteriorate materially throughout the normal life of the installation.

We could amplify the foregoing definition by adding to the specific applications which already exist in our code. We might say that wires should be soldered, electrically welded, brazed or connected together with proper mechanical connectors, without adding anything to our fundamental requirements.

If we should further state that any decision of the Bureau of Standards, Washington, D. C. (a department of the government), Electrical Testing Laboratories of New York (a laboratory supported by central stations) or the Underwriters' Laboratory of Chicago (a private laboratory supported by individuals connected with insurance companies) as to any facts necessary to a decision would form sufficient basis for such decision, it is obvious that any inspection department in the field with

this simple rule and with the test report by one of these authorities would be able to decide in any case as to whether electrical and mechanical continuity are sufficiently safe.

Our second basic requirement is insulation. The present code attempts to establish values. We think it would be better if instead of establishing values, the code were made to read so that this function would be expressed by saying:

II. Insulation.
The insulation shall be sufficiently good so that the current which passes through it shall not of its own effect tend to increase.

It is obvious that in practice there is no insulation so perfect that it will not pass some current, and if we base our criterion upon this, it is sufficient to say that not enough current shall pass to cause the insulation to destroy itself or to be dangerous to property or life. This puts the question of the fact up to the laboratory where it belongs and leaves the rule-making authority in the position of having fairly stated the needs of the case.

In similar manner we have attempted to compose wording for basic rules covering the other fundamental requirements, as follows:

III. Protection of Insulation.
(a) The insulation of a wiring system, where exposed to mechanical injury, shall be protected by coverings, casings or guards of metal or wood to minimize the risk of damage thereto.
(b) Where exposed to extraordinary heat, the insulation shall be of a nature to resist deterioration due to this cause.
(c) Where exposed to dampness, corrosive vapors, etc., the insulation shall be protected against deterioration by its nature, its isolation, or its manner of installation.
IV. Protection Against Fire Risk.
(a) The current-carrying capacity of a conductor shall be ample and sufficient for the current it normally carries.
(b) All circuits shall be protected by circuit-opening devices against dangerous overload and short circuits.
(c) Easily inflammable materials shall not be allowed to come in contact with conductors or their insulation.
V. Protection Against Risk to Human Beings.
All conductors and live parts (ungrounded) shall be protected by insulation, or by shielding, against risk of shock to human beings through accidental contact therewith.
All installations shall be protected against human risk arising from accidental superimposed dangerously high voltages.
VI. Identification.
Where necessary for proper identification, materials, devices, etc., shall bear identifying marks or labels.
VII. Conformance with Code.
Installations shall be so made that it is possible to ascertain if the provisions of the code have been followed.
Conductors shall be tested at the factory.
Certain departures from the rules of the code may be allowed by special permission of the local inspector.

If the industry agrees on this program, it would seem that certain practices should be adopted relative to the national code. The seven fundamentals should be expressed at the beginning of the code exactly as one writes a constitution and by-laws, the seven fundamentals to come first as a constitution. There should be an additional basic rule reading that any wiring, wiring device, etc., even though not specifically covered or mentioned in the code, shall be permitted by a local inspector either (a) when its use is clearly within the intent of the seven fundamentals or (b) provided that the conformance of its technical quality to the requirements of the seven fundamentals is certified by one of the three laboratories named or some laboratory other than the three nationally agreed to which is specifically selected by the local authorities for the purpose.

Every rule in the code should then be classified (by titular reference) as to the fundamental rule or rules by which it is authorized.

WHERE THE RULE APPLIES

The following letter, addressed to Victor Tousley, chief of the electrical department of the city of Chicago, presents some comments and criticisms on Mr. Doane's treatise on the need for a constitution for the code. These comments and criticisms are submitted by H. G. Knoderer of the General Electric Company, Bridgeport, a member of the National Electric Light Association wiring committee. They are recommended by him for consideration in connection with the preliminary report of the Doane sub-committee.

"The National Electrical Code of the American Engineering Standards committee must be recognized by all as an American standard of installation rules of electrical material for the protection of the interests of the ultimate user against fire and co-ordinated life and safety hazards. As Mr. Doane says: 'Analysis shows that there are only seven fundamental requirements in the whole code.' If these seven fundamentals' can be properly and clearly stated, they could be printed as a prologue in the printed edition of the code and could be adopted as the bylaws of procedure used and to be used upon future rebuilding or changes of the code. Thus gradually the code would rise out of the mire of incorrect interpretations of the meaning of its various rules.

"It is not, herewith, my intention to discuss Mr. Doane's paper relating to the 'seven fundamentals' and its accompanying discussion, except as follows:

"A. An additional fundamental existing in the code and rapidly becoming a prevalent tendency in the rebuilding of the code is the needed requirement to clearly state 'where the rule applies.' Whether this 'where' should be added as an additional 'fundamental' or can be incorporated into the 'seven fundamentals' set forth is not pertinent at this moment. A close study of the present code and a clear knowledge of the present tendencies existent thereto assure the absolute necessity of incorporating this point when considering a hazard rule, be it for life or fire.

"It is this element of 'where' that makes me somewhat skeptical of results to be achieved such as are outlined in Mr. Doane's treatise.

"B. A technical investigation to devise and set up standards dealing with physical values and physical results will never be self-sufficient to determine installation rules for protection to life and for fire hazard. The physical characteristics of a product may logically allow for safe usage in one place, while in another place the same rule may be extremely hazardous. This standard of physical characteristics can never be the guide for safety practices, even though use of material under this standard be guided by the 'seven fundamentals.'

"The very best inspector or operator is limited in his knowledge to his particular field of experience, and therefore when he steps beyond this field he is not able to determine safety intelligently from a physical standard, even though backed by the suggested 'fundamentals' outlined.

"C. If the point brought out in the above were not true, and if paragraph 4, page 3 and last paragraph page 3, and A and B of page 4 and Mr. Doane's treatise were to prevail, there would

Delinquent Electrical Accounts

(Data Supplied by National Electrical Credit Association)

NUMBER OF ACCOUNTS REPORTED

Division	February 1925	February 1926	Per Cent Increase or Decrease	Two Months (Jan. and Feb.) 1925	Two Months (Jan. and Feb.) 1926	Per Cent Increase or Decrease
New York	334	341	+2	642	632	— 1.5
Middle and Southern Atlantic States	242	176	—37½	419	337	—19.5
New England	60	70	+16.6	125	130	+ 4
Pacific Coast	18	25	+38.8	40	55	+37.5
Central	802	940	+17	1,566	1,693	+ 8.1
Total	1,456	1,552	+ 6.6	2,792	2,847	+ 1.9

TOTAL AMOUNTS REPORTED

Division	February 1925	February 1926	Per Cent Increase or Decrease	Two Months (Jan. and Feb.) 1925	Two Months (Jan. and Feb.) 1926	Per Cent Increase or Decrease
New York	$79,033	$52,474	—33.6	$121,219	$89,809	—25.8
Middle and Southern Atlantic States	28,614	17,147	—40	72,310	32,310	—54.6
New England	7,601	10,118	+33.1	14,178	19,732	+39.2
Pacific Coast	6,239	3,762	—39.7	9,014	8,526	— 5.4
Central	102,162	54,016	—47.1	205,152	145,582	—29
Total	$223,649	$137,517	—38.5	$421,873	$296,555	—29.7

AVERAGE AMOUNTS

Division	February 1925	February 1926	Two Months (Jan. and Feb.) 1925	Two Months (Jan. and Feb.) 1926
New York	$237	$154	$189	$142
Middle and Southern Atlantic States	118	97	172	97
New England	126	144	113	151
Pacific Coast	346	150	225	155
Central	127	57	131	85

be no need for a code other than the 'seven fundamentals' and a set of physical standards.

"If a set of 'fundamentals' such as set forth by Mr. Doane could be adopted as the bylaws of the code, I believe that this wiring committee of the N.E.L.A. would have done a wonderful work in bringing into existence a new era of installation procedure laws that would be a boon to the well-being and interests of the ultimate user.

"May I therefore suggest that this be accomplished after further consideration of 'fundamentals' by having the wiring committee through regular procedure request of the N.E.L.A. that the accredited representatives of the N.E.L.A. on the American Engineering Standards Committee submit these 'seven fundamentals' in proper form as an amendment to the scope of the project set before the sponsors (N.F.P.A.) of the A.E.S.C. in producing and maintaining a National Electrical Code?"

Business Conditions

MANUFACTURERS generally report sales to date as being greater than for the same period last year. Some slowing up of current business is noted, but inquiries are in large volume and a fair amount of projected work is expected to become active next month, so that the industry is optimistic as to future sales. Transmission-line materials have been in active demand, and a large amount of business, particularly in the Southeast, has resulted from utility consolidations recently consummated.

In New England special appliance sales are active, particularly electrical recording instruments, meters, arc-welding equipment and electric power-driven tools. Many inquiries are being received for control equipment and line supplies, one order for insulators amounting to about $70,000. Small-motor sales continue to gain, and interest in industrial heating is strong. Central-station companies are active in the New York district, particularly in the field of transmission-line materials and control equipment. The industrial market is somewhat spotty, but there is a good demand for motors for refrigerating purposes, ice machines and ventilating and air-cooling systems. In the Southeast utility consolidations are creating an active business. Conditions are reported as satisfactory, and though there are some quiet spots other sections are extremely active. Electric range sales are reported to be increasing very rapidly. Considerable industrial activity is noticed in North Georgia and Alabama, and especially in the Birmingham district. Utility extension plans in the Middle West have created considerable interest, and industrial activity is noticeably good. On the Pacific Coast power-company purchasing is good, with pole-line hardware predominating. There have also been a large number of repair-part orders reported.

Lead in Strong Demand—Other Non-Ferrous Metals Weak

The demand for lead has been good all week at prices that have been somewhat improved, despite the efforts of the principal sellers to avoid temporary fluctuations in the market. The other metals have been in only small demand and prices have weakened on copper, zinc and tin. Domestic consumptive demand continues excellent in most lines, though somewhat quieter conditions are expected in the summer. Some of the larger producers of copper made an effort to hold the price at 14¼ cents, but the demand was so small that practically nothing could be sold at that level and plenty of sellers were found who were willing to shade prices. By Monday or Tuesday most sellers had reduced their quotations to 14⅛ cents, delivered in the East, but again urgent sellers appeared who were willing to make concessions. On Tuesday and Wednesday a fairly good tonnage was sold at and close to 14 cents, delivered in Connecticut, though quotations at that level have not been broadcast and most sellers have hesitated in going below 14.10 cents even on attractive business. Consumers, especially brass and wire and cable companies, report no let-up in demand so far, though they are playing safe and not buying far ahead. Most of the copper sold has been for April and May delivery.

Lead sales, particularly in the West, have been unusually active. Although the American Smelting & Refining Company has maintained its official price for lead, delivered at New York, at 8.20 cents per pound, a fair premium has been realized on most of the sales made. Outside prices range from 8¼ cents to 8⅜ cents in this market. Several of the important producers are fairly well sold through April, but one reports that it has adequate supplies for that month. Most of the business has been for April delivery with some inquiries for May. Zinc showed a little strength last week when business was booked at 7¼ cents, but has again weakened. Galvanizers report their mills working to only about one-third capacity in many instances, with business getting worse instead of better. On the last three days of last week a moderate business was done in selling spot tin to consumers. The price has declined in sympathy with London since Monday and apparently is scaring buyers away.

NEW YORK METAL MARKET PRICES

	Mar. 17, 1926 Cents per Pound	Mar. 24, 1926 Cents per Pound
Copper, electrolytic	14⅛–14.20	14
Lead, Am. S. & R. price	8.20	8.20
Antimony	19	19⅛
Nickel, ingot	35	35
Zinc, spot	7.80	7.60
Tin, Straits	66	64⅛
Aluminum, 99 per cent	28	28

Base copper price March 24, 1926, 16½ cents

Pole-Line Hardware Sales Predominate on Pacific Coast

Power-company purchasing on the Pacific Coast is good, with pole-line hardware sales predominating. An aggregate of three carloads were purchased through San Francisco and many sales were reported in the Puget Sound district. Power-company inquiries have included fuse plugs, cartridge fuses, one carload of 65-ft. poles and an exceedingly large aggregate of construction and maintenance tools. A surprising number of repair-part orders for turbine, transformer and street-railway equipment, as well as motors for pulp and paper mills and oil circuit breakers, compose the bulk of the present business.

Scattering orders for motors for mill electrification have been reported, and an inquiry has been received by manufacturers from a planing and lumber manufacturing plant for $15,000 worth of motors. A fair quantity of motors for irrigation purposes are also in demand. The range campaign in northern and central California is moving rather slower than was anticipated, with one-third of all the present sales being made in the East San Francisco district.

Utility Consolidations Create Active Business in Southeast

The volume of business throughout the Southeast is reported as satisfactory, though there are some quiet spots in the territory, while other sections are extremely active. In south and east Georgia business is on a very active basis, with continued purchases of isolated utility companies for consolidation into larger systems, and these purchases are responsible for no small percentage of the excellent orders received for poles, wire, cross-arms and pole-line hardware, with a reasonable volume of high-tension-insulator and apparatus orders to be noted, as well as orders for merchandise stocks. Electric range sales are also reported to be increasing very rapidly.

Activities in Florida are somewhat spotty, but turbine inquiries from this state continue good. One order for a 5,000-kw. turbine unit for installation at Orlando, Fla., was reported by a manufacturer last week, together with satisfactory orders for distribution transformers and house-type meters. North Georgia and Alabama, particularly in the Birmingham district, report considerable industrial activity. Several very satisfactory orders were placed for industrial construction materials.

Central-Station Companies Active in New York District

Public utility companies continue as active buyers in the New York district, particularly in the field of transmission-line materials and control equipment. One manufacturer of control apparatus reports that the volume of central-station business so far during March greatly exceeds the previous months of this year. Sales of transformers are active and orders include one from a holding company amount-

ing to about $15,000. The industrial market is still somewhat spotty, the demand for small and medium-sized motor equipments for general purposes showing very little activity. On the other hand, motors for refrigerating purposes, ice machines and ventilating and air-cooling systems are selling well, and one manufacturer reports that his sales in this field so far this year are about equal to those of five months of last year. One order for about $10,000 worth of motors for ice-manufacturing plants was placed during the week. Jobbers report a continuation of the inactivity of the past few weeks, although they are also noticing a demand for electric refrigerators for household use.

Special Appliance Sales Active in New England District

Special electrical appliance sales—and in particular electrical recording instruments, meters, arc-welding equipment, and electric power-driven tools—show an encouraging gain in sales throughout the New England district. The trend in electrical recording instrument sales is reported to be about normal. Arc-welding units are receiving much attention, and many sales are reported in this district, one of which includes four units for a structural concern that has adopted welded joints in place of riveted joints in the construction of steel chimney stacks. Meter sales are steady and show greater strength this month than last, owing to heavy demands from new construction projects.

Central-station supplies are in more active demand, and many inquiries are being received for control equipment and line supplies. One order for insulators amounting to about $70,000 was recently received for new construction in southern New Hampshire, and a number of negotiations are under way for further line extensions in this district. Small-motor sales continue to gain. A prominent manufacturer records over 30 per cent increase to date as compared with the volume of last year for the first quarter, and another reports good demands from a number of textile mills for motors in sizes of 50 hp. and up for replacement. Industrial heating interest is strong, and orders for two 30-kw. furnaces for installation in middle Western plants have been received by a well-known manufacturer. Jobbers report that sales are spotty.

Utility Extension Plans Create Interest in Middle West

Industrial activity is noticeably good in the Middle West, and an optimistic, confident feeling is apparent everywhere. The various public utility companies are particularly optimistic and are actively engaged either in present construction work or in planning future extension. An announcement of another large super generating station of 1,000,000-kw. ultimate capacity for the Chicago district was made this week. Considerable quantities of various apparatus are being bought, probably the most interesting order being for a 90,000-kw. compound turbo-generator unit. There has been an excellent demand for cables of all descriptions and a good demand for distribution equipment. There has also been a good demand for motors, control equipment and wiring devices. Jobbers' sales continue good, with an excellent demand for appliances. The campaign conducted by central-station companies and jobbers on toasters is resulting in quantity sales of these appliances.

Activities of the Trade

Walter Bates Steel Corporation to Manufacture Steel Specialties

The Walter Bates Steel Corporation, just organized by Walter A. Bates, formerly vice-president of the Bates Expanded Steel Truss Company, will commence the manufacture about June 1 of a new design of steel poles, towers, substations and other steel fabrications and specialties for use by public utilities. A fabricating shop and a special department for the manufacture of poles and other specialties are being equipped. Before fall the company expects to have its own galvanizing plant and to augment its present force. This new company is situated on East Fifth Avenue, Cary, Ind. The Bates Expanded Steel Truss Company has no interest in the new Walter Bates Steel Corporation, the two companies not being associated in any manner.

American Resistor Corporation Elects New Directorate

The annual stockholders' meeting of the American Resistor Corporation, Milwaukee, manufacturer of "Globar" heating elements, was held in New York City last month. The following directors were elected for the ensuing year: Joseph A. Steinmetz, president; Walter W. Perkins, vice-president and treasurer; W. E. Duersten, vice-president in charge of operations; H. S. Shelmerdine, W. J. Buff, Leo N. Sharpe and F. E. Keeler.

R. G. Hess, for the past six years technical purchasing agent for the United Fruit Company, was recently appointed assistant sales manager in charge of domestic application of the products of the company. The company also announces that it has recently opened branch offices in Cleveland and San Francisco.

General Electric's Annual Report Shows Increased Exports

The thirty-fourth annual report of the General Electric Company shows that orders received during the year 1925 were $302,513,380, which compares with $283,107,697 in the year 1924, an increase of 7 per cent. Unfilled orders at the end of 1925 were $77,860,000, while at the end of 1924 they were $68,958,000. The net sales billed in 1925 were $290,290,165, and in 1924 they were $299,251,869. The cost of the manufacturing plants of the company now in use is reported at $184,844,175, and, allowing for general plant reserve and depreciation, a net book value of $55,168,837 is carried on Dec. 31, 1925. The company's investments in associated manufacturing and distributing companies have been appraised and are carried at a net valuation of $56,265,398, which compares with $51,862,287 at the end of 1924.

The only funded debt of the company outstanding on Dec. 31, 1925, was $2,047,000 of 3½ per cent gold debenture bonds due in 1942. The company has no notes payable, or any obligations bearing its indorsement, outstanding. The only contingent liability is in connection with employees' activities, for which adequate reserves have been provided. The profit and loss account of the company shows a profit of $38,641,217 available for dividends. The surplus on Dec. 31, 1925, was $85,848,170. The total of all orders received by the International General Electric Company during the year 1925 was $25,710,000, as compared with $17,590,000 during 1924. The portion of its orders and billing which was for General Electric products is included in the corresponding figures of the General Electric Company at the cost to the International company.

Brown Boveri Reports Promising Prospects for 1926

The president of the American Brown Boveri Electric Corporation, Laurence Wilder, has issued a report covering the period since the company's organization in October, 1925. This report will be mailed to stockholders at an early date and will be accompanied by a consolidated balance sheet as of Dec. 31, 1925, showing current assets of $12,899,872, including cash and United States government securities of $958,784, against total current liabilities of $1,036,529.

The report states that the corporation's prospects for 1926 are very promising. Earnings of the corporation and associated companies for 1925 aggregated $1,567,000 after allowing for depreciation, interest charges and minority interest in subsidiary companies, but before deduction of federal taxes.

The Hoover Company, North Canton, Ohio, manufacturer of vacuum cleaners, announces that Thomas F. Kelly, vice-president of the Hoover Company, Ltd., Hamilton, Ontario, Canada, has been transferred to Chicago as branch manager at that point.

The General Electric Company announces that it is now marketing a new soldering iron of light construction, designed to heat up quickly, and made in standard sizes ranging from a ¼-in. to a 1¼-in tip.

The Fermot Company, 200 Broadway, New York City, announces that it is the sole agent for the "Simbi" elec-

trically driven hammer for operation on alternating current.

The American Wiremold Company, Hartford, Conn., at a recent meeting of its board of directors voted to increase its capital stock from $200,000 to $600,000. A new issue of $200,000 of 6 per cent cumulative participating preferred stock was voted and $200,000 worth of earned surplus was placed into common stock and issued as a stock dividend. The company intends to develop new wire specialties paralleling its present lines of flexible non-metallic conduit, metal raceways, etc.

The Erie Malleable Iron Company, Erie, Pa., announces that P. S. Klees has joined the organization as district manager of the "Kondu" division for New York and Boston with headquarters at 50 Church Street, New York, and 161 Devonshire Street, Boston. For the last six years Mr. Klees was sales manager of the Tubular Woven Fabric Company of Pawtucket, R. I.

The National Carbon Company, 30 East Forty-second Street, New York, has awarded a contract for the erection of a factory addition to its plant at Niagara Falls, N. Y.

The Hobart Brothers Company, Troy, Ohio, announces that it has developed a special portable air compressor unit, utilizing its standard HB silent twin automatic air compressor.

The Sterling Varnish Company, Pittsburgh, announces that J. S. Applegate, formerly with the Wagner Electric Corporation, has become associated with the company as a specialist in electrical insulation.

The Limpert Ice Machine Corporation, Babylon, N. Y., is now manufacturing two sizes of household ice machines using a non-corrosive refrigerant gas. The machine is almost completely die-cast and ball bearings are used throughout. The unit, which requires low starting torque, uses a ¼-hp. split-phase induction motor.

The Trico Fuse Manufacturing Company, Milwaukee, announces the following appointments to its sales organization: Herbert E. Hartstein has been made Eastern sales manager, Philip Rypinski, Central sales manager and Fred C. Geiler, Western sales manager. The company has recently made many changes in its plant, including enlarging and rebuilding its electrical testing laboratory and offices.

The Monitor Controller Company, Baltimore, announces the establishment of the Electric Material Company of San Francisco and Los Angeles as its Pacific Coast representative. For a number of years the Electric Material Company has been representing such electrical manufacturers as the Ward Leonard Electric Company, the Roller-Smith Company, the G. & W. Electric Specialty Company and the Autovent Fan & Blower Company.

The Kelvinator Corporation, Detroit, has opened a factory branch office in Atlanta, to be known as the Kelvinator-Atlanta, Inc. L. S. Bullis has been appointed manager. The company will act as a wholesale and retail distributor of Kelvinator refrigerating machines in the Atlanta territory.

The General Electric Company announces that the copper tungsten electrode which it evolved is now available for use in manufacturing. The material has been given the trade name "Elkonite" and will be manufactured and sold exclusively by the Elkon Works, Inc., of P. R. Mallory & Company, Weehawken, N. J.

The Whiting Corporation, Harvey, Ill., has just made an unusually large crane shipment, consisting of two electric traveling cranes, to the New York Edison Company for erection in the East River station, New York City. Each crane has a main hoist of 200 tons capacity and an auxiliary hoist of 25 tons capacity, with a span of 58 ft. and a vertical lift of 110 ft.

The Crouse-Hinds Company, Syracuse, N. Y., announces that it has placed its new type GC condulet on the market. This condulet, No. 2085, is intended for grounding service wire and conduit systems.

The Chicago Fuse Manufacturing Company, Laflin and Fifteenth Streets, Chicago, manufacturer of electrical protecting materials and conduit fittings, announces the appointment of L. F. Blendermann as district sales manager at Philadelphia.

The Jewell Electrical Instrument Company, 1640 Walnut Street, Chicago, has awarded a contract for the erection of a two-story-and-basement addition, 75 ft. x 100 ft. in size.

The Westinghouse Electric & Manufacturing Company is said to have preliminary plans under consideration for the erection of a new plant at Valdosta, Ga., for the production of spun-metal lighting standards and similar products.

The Simplex Wire & Cable Company, Boston, announces that its "Tirex" cables are now being made with the rubber armor consisting of selenium rubber. The process of vulcanizing rubber with selenium was developed in the company's laboratories, and this art of rubber compounding is said to increase the toughness or wear-resisting qualities of a rubber compound 50 per cent.

The Mueller Electric Company, 1583 East Thirty-first Street, Cleveland, manufacturer of "Universal" test clips, announces that it is adding an additional floor to its factory to take care of the increased demand for its products.

The Driver-Harris Company, Harrison, N. J., manufacturer of special alloys, announces the appointment of J. C. Bilek as Chicago district manager. Mr. Bilek has been with the company for the last sixteen years and was formerly in charge of the New York territory. H. D. Tietz, who has also been with the company for several years, will be associated with Mr. Bilek as assistant district manager.

The Formica Insulation Company, 4614 Spring Grove Avenue, Cincinnati, will proceed with the construction of a two-story addition to its plant, 80 ft. x 100 ft.

The American Brown Boveri Electric Corporation, 165 Broadway, New York, announces that L. J. Galbreath, until recently engaged in advertising and sales promotion activities for the Bridgeport Brass Company, has been appointed publicity and sales promotion manager and will act as assistant to Earl G. Hines, recently appointed general sales manager.

New Equipment Available

Meter Service Entrance Switches

A channel-type class A accessible service fuse switch for banked meter installations has been placed on the market by the Wadsworth Electric Manufacturing Company, Covington, Ky. These switches are of the type required for use in Detroit after April 1. When the switches are banked they allow 10¾-in. centers, but channel spacers can be furnished for use where wider centers are required. The company also announces its No. 238 branch-circuit-type service switch, superseding its No. 282. The No. 238 is a shorter cabinet by approximately 1¾ in. and is the same length as the "Universal" switch.

Recording Demand Meter

A recording demand meter that prints directly the demand for each interval, known as the type PD demand meter, has been placed on the market by the General Electric Company. With previous designs it was necessary to subtract consecutive readings in order to obtain the correct demand, but in the new meter the printing wheels return automatically to zero at the end of each interval and print directly the demand for each interval.

The type PD demand meter also contains three extra dials or indices. One of these shows the maximum demand which the meter has recorded since it was last manually reset; the second shows the present interval demand, that is, the number beneath the printing platen at that time, and the third dial, or cyclometer, registers the total number of contacts delivered to the demand meter. The latter provides a means of verifying the registration of the demand meter by comparing it with the watt-hour meter register with which it is coupled.

Grade Crossing Traffic Signals.—A line of traffic signals known as type TSP has been placed on the market by the Crouse-Hinds Company, Syracuse, N. Y. These signals are controlled by a manually operated switch with telltale lamps in series with signal lamps placed above the switch, which is installed in the flagman's house. These signals are arranged so that the bell rings continuously when the red lights show in the direction of vehicular and pedestrian traffic. The type TSP signals are built in two sections, furnished for one-way, two-way, three-way and four-way operation, and can be arranged for overhead or underground feed.

New Trade Literature

APPARATUS FOR BURNING PULVERIZED FUEL.—"C-E Unit System for Burning Pulverized Fuel" is the title of catalog U-1 issued by the Combustion Engineering Corporation, Combustion Engineering Building, Broad Street, New York City, in which it describes and illustrates the "C-E" unit system for burning pulverized fuel by the direct-fired method. It contains details of construction and operation of the mill with views showing applications of the "C-E" unit system to different types of boilers. The catalog contains a discussion on furnace design in connection with the development of the "C-E" unit system.

AIR-BREAK SWITCHES.—Bulletin No. 16 issued by the Bowie Switch Company, 85 Second Street, San Francisco, covers its types G, GA and L Bowie gang-operated, heavy-duty, high-voltage air-break switches, designed for indoor and outdoor use. It contains numerous drawings showing various applications of the switches as well as tables of dimensions. Descriptions of the insulators used and the controls for the various types of switches and complete switch specifications are also included.

MATERIAL-HANDLING EQUIPMENT.—The Lewis-Shepard Company, Watertown Station, Boston, is distributing its 1926 catalog covering the Lewis-Shepard labor-saving handling equipment, including its "jacklifts" and "stackers" for use in various industries.

STAGE-LIGHTING EQUIPMENT.—Catalog M issued by Kliegl Brothers, Universal Electric Stage Lighting Company, Inc., 321 West Fiftieth Street, New York City, contains a complete line of lighting specialties and lighting effects for the stage and for theaters, motion-picture studios, window displays, showrooms, outdoor floodlighting, spectacular advertising, etc.

CONDULETS.—Bulletin No. 2085 issued by the Crouse-Hinds Company, Syracuse, N. Y., describes and illustrates its new type "GC" condulet for grounding service wire and conduit system. Bulletin No. 2086, entitled "Safety 'Arktite' Plugs and Receptacles, Interlocking Switches and Plugs, Safety Hand Lamps," contains instructions for use of these devices and also illustrations showing various applications.

GEARS.—Publication C-1579-D, entitled "Micarta Gearings and Pinions," issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., explains the change in the computation of the horsepower ratings of the "Micarta" gears, based on the use of a fiber stress figure of 6,000 lb. in place of that of 5,000 lb., previously used. It contains tables that will assist the gear manufacturer in calculations on "Micarta" gears. Examples of how to calculate the horsepower ratings, tables giving the preferred pitch, the values of the constants used, gear data and horsepower ratings at various pitches are included.

OIL-IMMERSED TRANSFORMERS.—Pamphlet Te151 issued by Ferranti, Ltd., Hollinwood, Lancashire, England, describes and illustrates the Ferranti oil-immersed transformers.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Castle Bar, Ireland (No. 19,571), for automobile and motor cycle accessories, especially bulb and electric horns, pumps, windshield wipers, etc.

Purchase is desired in Melbourne, Australia (No. 19,672), of electrical equipment for plate-shearing machine.

An agency is desired in Sydney, Australia (No. 19,594), for electrical and motor accessories.

An agency is desired in Pernambuco, Brazil (No. 19,580), for electrical household devices.

Purchase is desired in São Paulo, Brazil (No. 19,646), of insulators for electrical installations.

An agency is desired in Madrid, Spain (No. 19,575), for material for railroad electrification and copper wire.

Purchase is desired in Durango Mexico (No. 19,664), of telephone serial cables, suspender hooks, switchboard supplies, etc.

An agency is desired in The Hague, Netherlands (No. 19,603), for electric warehouse trucks, conveyors, portable electric warehouse trucks, and station and warehouse trucks.

Purchase is desired in Colombo, Ceylon (No. 19,639), of bare and insulated copper wire, plain bright and galvanized wire, rope, fence and barbed wire, and steel telegraph and telephone wire.

Purchase is desired in Copenhagen, Denmark (No. 19,659), of cloth-cutting and power sewing machines.

Purchase is desired in Teneriffe, Canary Islands (No. 19,598), of Diesel engines and refrigerating machinery.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MARSHFIELD, VT.—Arrangements are being made by the Green Mountain Power Company, Montpelier, a subsidiary of the Montpelier & Barre Light & Power Company, for the construction of a hydro-electric power plant at Molly's Falls, near Marshfield with an initial capacity of 7,000 hp., to cost about $750,000. A transmission line will be erected to Montpelier, about 16 miles distant.

READING, MASS.—Arrangements have been made by the Municipal Light Commissioners with the Edison Electric Illuminating Company of Boston to supply electricity for the municipal electric system. Two 5,000-kv. underground lines will be extended from Stoneham to the Reading station, where substation equipment will be installed.

NEW LONDON, CONN.—Plans have been filed by the Connecticut Power Company for the erection of two additions to its power plant on Water Street. Additional equipment will be installed.

Middle Atlantic States

ANGOLA, N. Y.—The installation of new ornamental lamps in the business district is under consideration by the Village Trustees.

BROOKLYN, N. Y.—The American Sugar Refining Company, 117 Wall Street, New York City, will completely remodel its sugar refinery. The project includes the construction of wharf and warehouses, enlargement of sugar storage and shipping facilities, erection of new syrup station, rebuilding of boiler house and rearrangement of generating equipment. New machinery will be installed in many departments. Stone & Webster, Inc., Boston, engineer, is in charge of all construction work.

GENEVA, N. Y.—The Empire Gas & Electric Company has been granted permission to exercise a franchise in a portion of the town of Hopewell.

GOUVERNEUR, N. Y.—Plans are being considered by the W. H. Loomis Talc Corporation for the construction of a large hydro-electric development on the Oswegatchie River, near Gouverneur. Power from the proposed plant will be used in the talc mills, the surplus will be transmitted near-by districts.

NEW YORK, N. Y.—Electric power equipment will be installed in the printing plant to be erected at 401-27 Water Street by the New York Evening Journal Company, 238 William Street, to cost about $800,000.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company, W. C. Bower, manager, Purchases and Stores, Room 344, 466 Lexington Avenue, until March 29, for railway motors, multiple unit control equipment and accessory apparatus. (Serial Contract No. 5-1926.)

NORTH CLYMER, N. Y.—Plans for rebuilding the lumber mill of William Gulick, recently destroyed by fire, include a power plant.

PITTSFORD, N. Y.—The installation of a new street-lighting system on North and South Main Street, Monroe Avenue and State Street is under consideration. The plans call for 200-cp. lamps erected on ornamental standards, to be maintained by underground wires.

ROCHESTER, N. Y.—The City Council is considering the installation of ornamental lamps on East Avenue. The Rochester Gas & Electric Company furnishes the street lighting service.

ROME, N. Y.—Bids will be received by the Superintendent of Purchase, Capitol, Albany, until April 8, for construction and heating work, addition to power house, etc., at the State School for Mental Defectives, Rome.

CALIFON, N. J.—The New Jersey Power & Light Company, Dover, which is negotiating for the purchase of the system of the Califon Electric Light & Power Compnay, plans extensions in transmission lines in this district.

CARRICK, PA.—The Borough Council is negotiating with the Duquesne Light Company, Pittsburgh, relative to replacing the gas lamps now in use with electric lamps. The plans call for the installation of 285 electric lamps. Post office address is Mount Olive.

COAL CENTER, PA.—The West Penn Power Company, Pittsburgh, has applied for permission to erect a transmission line across the Monongahela River at Coal Center.

DOWNINGTOWN, PA.—The Downingtown Paper Company plans to install electric power equipment in the proposed addition to its local paperboard mill, to cost about $600,000.

FRANKLIN, PA.—The National Transit Company plans to rebuild its power plant, recently damaged by fire, with a loss of about $22,000.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company plans to erect an automatic substation on Eleventh Street near Pattison Street, to cost about $40,000.

PHILADELPHIA, PA.—The Philadelphia Electric Company has plans under way for the construction of a substation at Juniper and Waverly Streets. John T. Windrim, Commonwealth Building, is architect.

PHILADELPHIA, PA.—The Baltimore & Ohio Railroad Company, Baltimore, plans to install electric power equipment in its proposed produce terminal and cold storage plant at Delaware Avenue and Jackson Street, to cost about $8,000,000. H. L. Kimball is architect.

PHILADELPHIA, PA.—The City Council has authorized the purchase of three sites in North Philadelphia located at 1327 Mount Vernon Street, 1410-20 Louden Street, and 1326 Cumberland Street, on which it will build substations for the Broad Street subway system.

READING, PA.—The Metropolitan Edison Company, which has recently acquired the systems of the Gettysburg (Pa.) Electric Company, the Hanover (Pa.) Power Company, and the Cumberland Valley Light & Power Company, Mount Holly Springs, plans extensions in its transmission lines in those districts.

READING, PA.—The Reading Company, Philadelphia, plans to install electric power equipment in connection with extensions and improvements in the local car and locomotive shops of the Philadelphia & Reading Railroad, to cost about $4,000,000. The company has tentative plans under consideration for the electrification of a portion of its suburban lines, near Philadelphia.

WARREN, PA.—Plans are under way by the Borough Council for extensions and improvements to the street-lighting system, to cost about $10,000.

BALTIMORE, MD.—The complete electrification of the Mount Royal pumping station of the municipal waterworks, to cost about $200,000, is under consideration by the Water Department. Bernard D. Siems is water engineer.

CONOWINGO, MD.—Application has been made by the Susquehanna Power Company for authority to erect a transmission line from the Maryland-Pennsylvania State line from a point near Broad Creek to a point in the vicinity of Shore's Landing, to supply electricity to be used in connection with the construction of the Conowingo dam. Permission is also asked to build substations and branch lines across the Susquehanna River to points in Cecil County.

WESTON, W. VA.—Plans are under way by the West Penn Public Service Company, Pittsburgh, for the erection of transmission lines in different portions of Lewis County.

WASHINGTON, D. C.—Bids will soon be asked by the Chief of Engineers, United States Army, for two portable generator

sets, and also for a quantity of rubber-insulated, lead-covered wire.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, Washington, until April 9, for transformers in lots of 500, 1,000, 1,500, 2,000, and 2,500. (Circular C. P. 23260-1.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until March 30, for a large quantity of cable and wire for eastern and western yards (Schedule 5154).

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until April 6, for four ¼-hp. motors, three single friction electric hoists, one air compressor, 10,000 ft. No. 2 stranded copper wire, 300 lbs. magnet wire, 16,000 ft. No. 4 bare copper wire, 75 telephone cable terminals, 252 conduits, plugs, fuses, switches, etc. (Panama Circular 1727.)

North Central States

BAY CITY, MICH.—The Wildman Rubber Company plans to install electric power equipment in connection with extensions to its local mill, to cost about $230,000.

JACKSON, MICH.—Extensions and improvements are contemplated by the Consumers Power Company in its systems in this district during 1926, to cost $2,000,000.

NILES, MICH.—The Indiana & Michigan Electric Company, South Bend, Ind., which is negotiating for the purchase of the municipal electric power plant, plans extensions in transmission lines, in this section.

SAGINAW, MICH. — The Consumers Power Company, Jackson, plans extensions and improvements in transmission lines, substations and distributing system in this vicinity during 1926, to cost about $400,000.

PADUCAH, KY.—The erection of a transmission line from Earlington to Paducah, a distance of about 70 miles, is contemplated by the Kentucky Utilities Company, Louisville.

FRANKFORT, IND. — The New York, Chicago & St. Louis Railroad Company (Nickel Plate System), Cleveland, plans to install electric power equipment in connection with the proposed rebuilding of its local car repair and locomotive shops, recently destroyed by fire with loss of about $350,000.

GARY, IND.—Bids will soon be asked by the Gary Heat, Light & Water Company for the construction of a mechanical shop, equipment storage and distributing plant on Madison Street, to cost about $200,000. George W. Maher & Son, 157 East Erie Street, Chicago, are architects.

NEW CASTLE, IND.—The installation of an ornamental lighting system in the business district, to cost about $30,000, is under consideration.

AURORA, ILL.—Plans are under way to double the output of the plant of the Western United Gas & Electric Company at Aurora, by the installation of a 22,500-kw. unit this year, at a cost of about $4,000,000. A third unit of same rating is planned for the future.

SPRINGFIELD, ILL.—The Central Illinois Public Service Company has petitioned for permission to acquire the municipal electric plants at Divernon and Creal Springs.

BELLEVILLE, WIS.—The erection of a transmission line from Belleville to Verona, a distance of 15 miles, is under consideration by the Wisconsin Power, Light & Heat Company, Madison.

MADISON, WIS.—The Wisconsin Power & Light Company, which recently acquired the properties of the Scandinavia (Wis.) Light & Power Company and the Iola (Wis.) Light, Power & Manufacturing Company, plans to erect high-tension lines to connect these plants with its main system.

MINERAL POINT, WIS.—Plans are under way by the Wisconsin Power & Light Company, Madison, to erect a 4,000-volt transmission line from Cokerville to Arthur to furnish electricity in Arthur and to intermediate rural consumers.

PORT EDWARDS, WIS.—The Nekoosa-Edwards Paper Company plans to build a power plant. E. P. Gleason is engineer.

FERGUS FALLS, MINN.—The Otter Tail Power Company which has recently acquired the electric plants in Walla Walla, Minto, Ardock, Fordville, Lankin and Adams, in North Dakota, plans to build a high-tension line to connect these systems. The project includes the construction of a power plant at East Grand Forks and the erection of a high-tension line from the plant to Devils Lake, which will supply power to the above named towns.

DUBUQUE, IOWA—The City Council is considering extensions and improvements in the street-lighting system. The Burns & McDonnell Engineering Company, Interstate Building, Kansas City, Mo., is engineer.

ELSBERRY, MO.—The municipal electric plant has been acquired by A. H. Latimer, Osage, Iowa, and J. W. Peterson, Cedar Rapids, Iowa. The new owners plan to install new machinery and to improve the distribution system.

HART, MO.—At an election held recently the proposal to build a municipal hydro-electric plant on the Pentwater River was carried.

KANSAS CITY, MO.—Bids will soon be asked for the construction of a power plant at the St. Mary's Hospital, Twenty-ninth and Main Streets, to cost about $85,000. The Burns & McDonnell Engineering Company, Interstate Building, is engineer.

ST. LOUIS, MO.—Preliminary plans are being prepared for a power plant, boiler house, coal receiving house, conveying house, pipe tunnels, etc., for the Howards Bend waterworks, on the Missouri River, to cost $325,000. A. Pritchard, is water commissioner.

TROY, MO.—The East Missouri Power Company is planning to extend its transmission lines to Foley, St. Peters, Gilmore, Hawkpoint, Truxton, Bellflower and Liege. Elections have been called in these towns to vote on granting franchises to the company.

NORTH PLATTE, NEB.—Bids will be received at the office of the Bureau of Reclamation, Denver, Col., until April 20 for furnishing one hydraulic turbine to deliver 3,400 hp. under a head of 65 ft.; one 8½-ft. butterfly valve, one 3,000-kva. generator, four 1,000-kva. transformers, switching apparatus, two 33,000-volt lightning arresters, two 33,000-volt oil circuit breakers, four 37½-kva. transformers, two 33,000-volt air break switches and twenty-one 33,000-volt disconnects and six 33,000-volt choke coils for the Guernsey power plant of the North Platte project, Nebraska-Wyoming project.

Southern States

RALEIGH, N. C.—Plans are under way by the Carolina Power & Light Company, now being organized, to take over the Carolina Power & Light Company, the Yadkin River Power Company, the Asheville Power & Light Company, the Pigeon River Power Company and the Carolina Power Company, for a power expansion program involving an expenditure of $20,000,000. The work contemplated by the company includes a new hydro-electric plant on the Yadkin River at the Norwood site, which is designed for an ultimate generating capacity of 85,000 kw. The initial installation will be 63,000 kw. Another hydro-electric plant on the Pigeon River on a site near the Tennessee state line will be built. The ultimate capacity of this plant will be about 75,000 kw., with an initial installation of 50,000 kw.

BOYNTON, FLA.—A franchise has been granted to the Florida Power & Light Company, Miami, to furnish electricity here.

MICANOPY, FLA.—Extensions and improvements to the municipal electric light plant are under consideration.

ST. PETERSBURG, FLA.—The St. Pinellas Power & Light Company contemplates building substations and extensions to transmission lines.

ERIN, TENN.—Work has been started by the Tennessee Electric Power Company, Chattanooga, on the construction of a steam driven generating plant in Erwin to furnish electricity in Waverly, McEwen, Erin, Hohenwald, Centerville and a number of other towns.

GAINESBORO, TENN.—The Tennessee Electric Power Company, Chattanooga, has been granted a franchise to furnish electricity in Gainesboro.

KNOXVILLE, TENN.—The D. M. Rose Lumber Company plans to build a power plant and the complete electrification of its mills. The cost is estimated at $200,000.

RIVERVIEW, TENN.—The installation of a municipal electric light plant is under consideration by the Council.

WHITEVILLE, TENN. — The Jackson (Tenn.) Railway & Light Company has been granted a franchise here, and plans to erect a 13,000-volt transmission line from Jackson to Whiteville with substation, water treating plant, etc., to cost about $20,000.

BIRMINGHAM, ALA. — Arrangements are being made by the People's Hydro-Electric Power Company for its proposed hydro-electric development at Lock No. 2 on the Coosa River. The plans provide for a development of 45,000 hp.

WYLAM, ALA.—Steps have been taken by the Wylam Merchants Association for the installation of an ornamental lighting system in the business section.

CENTREVILLE, MISS.—At an election to be held on April 5 the proposal to issue $16,000 in bonds for improvements to the municipal electric plant and water works will be submitted to the voters.

YAZOO, MISS.—The municipal electric plant has been acquired by the Mississippi Power & Light Company, Jackson.

MONTICELLO, ARK. — The Monticello Cotton Mills, Inc., plans to build a steam-operated electric plant in connection with an expansion program to cost about $230,000. Lockwood, Greene & Company, Healey Building, Atlanta, Ga., are architects and engineers.

WILMOT, ARK.—The Arkansas Light & Power Company, Pine Bluff, which is negotiating for the purchase of the plant of the Wilmot Light & Power Company, plans extensions to its transmission lines in this section.

BESSIE, OKLA.—Bids will be received by the City Council, E. E. Furechting, city clerk, until April 6, for the installation of an electric lighting system. John D. Bomford, Elk City, is consulting engineer.

COLLINSVILLE, OKLA.—at an election held recently the proposal to issue $81,000 in bonds for extensions and improvements in the municipal electric plant was defeated.

TONKAWA, OKLA. — Bonds to the amount of $30,000 have been voted for extensions and improvements to the municipal electric light plant and waterworks.

BANDERA, TEX.—T. W. North, Bandera, and associates plan to build an electric light and power plant for local service.

GOLIAD, TEX. — The property of the Goliad Supply Company has been acquired by the Texas Central Power Company. The new owners plan improvements to the electric and ice plants.

PORT ARTHUR, TEX.—Bids will be received by J. C. Hamilton, city clerk, until April 8 for furnishing two 10,000-gallons per minute low-service, one 2,100-gallon per minute, and one 3,500-gallon per minute high-service motor-driven pumps.

SAN ANTONIO, TEX.—The Texas Central Power Company, which has recently acquired the electric plants at Sabinal, Cotulla, Goliad, Hebronville, Schulenburg and Three Rivers, plans to connect these towns with its transmission system.

Pacific and Mountain States

ABERDEEN, WASH.—The City Council has commissioned Stevens & Koon, Spalding Building, Portland, Ore., consulting engineers, to make surveys and report on the feasibility of a municipal power plant on the Wynooche River. The cost is estimated at $700,000.

AVERY, WASH. — The Puget Sound Power & Light Company, Seattle, which has acquired the property of the Avery (Wash.) Public Utilities Company, the People's Utilities of Rochester and the municipal electric plant at Oakville, plans to extend its service to these towns, and to rebuild the distribution systems.

PORT ANGELES, WASH.—The Northwestern Power & Light Company has applied for additional water rights on the Elwha River, for a proposed hydro-electric development, with initial capacity of 16,600 hp., to cost $1,000,000, with transmission system.

SEATTLE, WASH.—The budget of the Puget Sound Power & Light Company for 1926 provides for an expenditure of about $4,000,000. The work includes increasing the output of the Baker River hydro-electric plant from 40,000 hp. to 50,000 hp., the erection of a new interurban and stage terminal station, extensions and improvements to service, including improvements to steam heating system, new substations, etc., and the completion of the cable connection between the mainland power system and the Olympic Peninsula. The latter involves the laying of

two cables of 10,000 hp. capacity each, with substations at each end.

YAKIMA, WASH.—Extensions are contemplated by the Pacific Power & Light Company, including the erection of a transmission line near Wapato, 11½ miles long, to serve a large rural district and the town of Harrah. An extension 6½ miles, near Parker, is also planned.

BAKER, ORE. — The Eastern Oregon Light & Power Company contemplates building an operating building and station at Main and Church Streets, to cost about $50,000.

KLAMATH FALLS, ORE. — The City Council is considering calling an election to vote on a bond issue of $350,000 for municipal improvements, including sewage disposal plant, paving, street-lighting system, etc.

PORTLAND, ORE. — The City Council has rejected all bids submitted for an improved lighting system on Grand Avenue, and will ask new bids at an early date.

BURLINGAME, CAL.—The City Council is considering the installation of an improved fire-alarm system.

LOS ANGELES, CAL.—The Board of County Supervisors has authorized plans for the installation of ornamental lamps on portions of Meadowbrook Road; Baker, Goodyear and Davis Streets; Morada Place; and New York Avenue, consisting of sixty-nine pressed steel standards.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on Santa Monica Boulevard from Normandie Avenue to Sunset Boulevard, using pressed steel standards, and also on Mines Avenue, using cast iron standards.

RICHMOND, CAL.—The Standard Sanitary Manufacturing Company, Bessemer Building, Pittsburgh, plans to install electric power equipment in connection with proposed additions to its local plant, to cost about $1,000,000.

SAN BERNARDINO, CAL. — The City Council plans to install ornamental lamps on Genevieve, Twenty-first, Platt, San Bernardino and Nineteenth Streets; Sierra Way, and Mountainview Avenue. Charles E. Johnson is city engineer.

SANTA ANA, CAL.—The City Council has authorized the installation of ornamental lamps on East Fourth Street from Main Street to Grand Avenue.

STOCKTON, CAL.—The Pacific Gas & Electric Company, San Francisco, plans extensions to its local machine shop and automobile service building, to cost about $10,000.

TULARE, CAL. — The City Council is considering a petition for the installation of ornamental lamps on North K Street, from King to Pine Streets.

GLASGOW, MONT.—The Montana Power Company, Great Falls, plans to erect a transmission line from Malta, to this district, to cost about $175,000.

CREEDE, COLO.—Plans are being considered by the City Council for a municipal hydro-electric plant. Carl A. Gould, First National Bank Building, Denver, is consulting engineer.

SILVER CITY, N. M.—The City Council contemplates extensions in the ornamental lighting system on Broadway and Bullard Street.

Canada

EDMONTON, ALTA.—The government of the Province of Alberta has adopted a resolution asking the Dominion Parliament to grant a license permitting the development of the water-power site at Spray Lakes. The cost of the main project is estimated at $14,352,200. The proposed plant would supply power to Calgary, Edmonton and twenty-three other municipalities.

ST. JOHN, N. B.—It is reported that an agreement has been reached between the provincial government, the International Pulp & Paper Company, Ltd., and Frasers Limited with regard to power development at Grand Falls. The cost of the project will involve an ultimate expenditure of from $25,000,000 to $40,000,000.

TORONTO, ONT.—Work has started by the Canadian Pacific Railway Company on the construction of a large terminal warehouse at the port of Toronto, to cost about $8,000,000. The warehouse will be equipped with cold storage and refrigerating facilities and an ice manufacturing plant.

MOOSE JAW, SASK.—Extensions to the municipal electric plant are under consideration.

Electrical Patents

Announced by U. S. Patent Office

Issued Feb. 23, 1926

1,574,580. ELECTRIC CIRCUIT BREAKER; W. M. Kay, Windsor, Ontario, Canada. App. filed Oct. 17, 1924. For automatically opening an electric circuit supplying current to an electric water heater.

1,574,581. ELECTRIC WATER HEATER; W. M. Kay, Windsor, Ontario, Canada. App. filed Feb. 12, 1925. Impervious to water, acids and the like; also with a heating element or unit to burn at a black heat and thus be free from oxidation.

1,574,582. ELECTRIC SIGN; C. Kern, Berlin-Tempelhof, Germany. App. filed Nov. 28, 1923. In which discharge tubes are used in the form of letters.

1,574,587. PROTECTIVE DEVICE; N. A. Lougee, Schenectady, N. Y. App. filed Feb. 7, 1918. As lightning arresters and similar devices which are operative to remove abnormal potentials, surges and similar discharges from an electric conductor. Of unit construction, each arrester comprising a plurality of discharge units, any number of which may be easily and quickly assembled to provide a composite arrester for the protection of a conductor under any operating voltage.

1,574,606. MEANS FOR AUTOMATICALLY CONTROLLING TRAFFIC; H. Cooke, Jr., Garfield, N. J. App. filed July 2, 1924. A motor-driven signal for use at street crossings.

1,574,640. STATIONARY INDUCTION APPARATUS; M. Unger, Pittsfield, Mass. App. filed May 26, 1921. Of the type applicable for use in connection with induction furnaces in which the charge constitutes the secondary of the transformer, a specific object being the provision of an arrangement which is rugged and is interlinkable with a furnace crucible.

1,574,648. SIGNAL SYSTEM; J. L. Hall, Schenectady, N. Y. App. filed Jan. 28, 1922. In which two continuously rotating shafts located respectively at the sending and receiving stations are provided. These shafts are automatically maintained in synchronism. One or more rotary indicators or drums are driven by the shaft in the receiving station through a yieldable operating connection. The indicator may be arrested in any desired indicating position by means of a plurality of latches, each latch corresponding to an indicating position. The latches are selectively actuated by means of an electromagnet which is controlled through contact mechanism driven by the shaft in the sending station.

1,574,674. COMBINED-SIGNBOARD AND FLASHER MECHANISM; W. W. McDaniels, Waupun, Wis. App. filed May 13, 1925.

(Issued March 2, 1926)

1,574,744. TERMINAL POST; E. L. Aiken, East Orange, N. J. App. filed Aug. 3, 1925. Which will take either a straight wire, a terminal or the ordinary spade clip.

1,574,747. AUTOMATIC BATTERY-CHARGING SYSTEM; C. Auth, New York, N. Y. App. filed July 19, 1923. Wherein storage batteries are employed as the source of energy for a service circuit and wherein the voltage of the batteries is automatically maintained at the proper value by charging the batteries from a lighting or other power circuit when their voltage falls below a certain point.

1,574,870. SAFETY FUSE; C. D. Cuny and H. W. Johnson, Washington, D. C. App. filed April 8, 1924. Safety device to be used in conjunction with the terminals of an electric fixture such as a lamp and its corresponding socket, and so arranged that it will be positive in action in disengaging the lamp or the like from electrical contact with its socket.

1,574,964. INSULATION EQUIPMENT; F. E. Getts (deceased), late of Chicago, Ill. App. filed Sept. 21, 1918. Insulator and interchangeable fittings; one insulator arranged to fit a great number of requirements, the only change being in the fittings.

1,574,979. CIRCUIT INTERRUPTER; J. W. Legg, Wilkinsburg, Pa. App. filed Dec. 13, 1920. Automatically discharges a condenser into an arc in response to movement of the latter and provides means for automatically inserting a resistor in series with an arc during the movement of the latter.

1,574,993. BUSBAR; D. F. Miner, Wilkinsburg, Pa. App. filed Sept. 24, 1920. A conductor so shaped as to compensate for the skin effect thereof, to effect thereby a uniform distribution of current therethrough; to eliminate undue heating and utilize the conductor effectively and economically.

1,574,996. FUSE-SWITCH MECHANISM; T. E. Murray, Brooklyn, N. Y. App. filed April 26, 1922. Switch mechanism and casing therefor, the whole arranged so that when access is provided to the terminals, for insertion of a fuse or for other purposes, the current is broken and when the circuit is closed the fuse terminals or the like are covered.

1,575,001. CIRCUIT BREAKER; K. C. Randall, Edgewood Park, Pa. App. filed June 30, 1921. Inclosed circuit breaker and disconnecting switch, wherein means are provided for preventing the operation thereof except in the proper sequence.

1,575,009. FUSE AND CUT-OUT MECHANISM; A. B. Rypinski, Laurelton, N. Y. App. filed May 16, 1924. Such as are generally used in entrance boxes for electric circuits.

1,575,010. LIMIT SWITCH; G. B. Scheer, Berkeley, Cal. App. filed April 29, 1922. For limiting the period of operation of a motor; adjustable limit switch that shall be capable of effecting small movements of the apparatus to be controlled, such as the edging rolls in a reversing steel mill.

1,575,029. SWITCH MECHANISM; H. G Baxter, Baldwin, N. Y. App. filed May 17, 1920. Quick-acting switch mechanisms for inclosed safety switches.

1,575,036. SWITCH MECHANISM; J. M Brown, Pittsburgh, Pa. App. filed June 9, 1920. Circuit interrupter adapted for use with electrical farm equipment and other apparatus; an interrupter that shall comprise a plurality of relatively movable contact members and operating means for engaging and disengaging the same in predetermined-sequence steps of permissibly different order during the opening and closing operations of the interrupter.

1,575,055. DEVICE FOR THE DISTANT CONTROL OF A MOVABLE MEMBER; N. Japolsky and M. Kostenko, London, England. App. filed June 9, 1924. Distant control of a movable member by means of an electric transmitter having a rotating part, which transmitter when the rotatable part is stationary supplies continuous current and when the said part rotates supplies an alternating current, the direction and frequency of which are dependent on the direction of rotation and speed of the said part. This device is characterized by the feature that the said current acts as the excitation current of an alternating-current commutator-generator, the terminals of which are connected to the stator of a synchronous motor driving the movable member, the frequency and terminal voltage of the generator being regulatable by varying the frequency and voltage of the current of excitation of the same.

1,575,076. ELECTRIC SWITCH; A. Page London, England. App. filed May 26, 1925. Intended for the control of circuits carrying a relatively small current, such, for example, as incandescent-lamp-lighting circuits; a type in which a contracting member is operated by an actuating member through the medium of a star wheel or the like with or without a ratchet and pawl device.

1,575,084. ELECTRICAL AUXILIARY ARRANGEMENT; R. L. Walsh, Washington, D. C. For storage-battery-generator lighting and power system.

1,575,096. MECHANISM FOR SYNCHRONIZING CLOCKS; T. S. Casner, Plainfield, N. J. App. filed March 24, 1921. Electromagnetic mechanism by means of which a clock may be periodically corrected by electrical impulses transmitted through space.

1,575,117. OXIDE TERMINAL; A. D. Keene, Pittsburgh, Pa. App. filed Oct. 15, 1923. Terminal members for electric resistance furnaces; of the metallic resistor type.

1,575,168. LIGHTING FIXTURE; P. Kestell, San Francisco, Cal. App. filed Oct. 14, 1924. Suspended lighting fixture generally known as a chandelier.

1,575,172. SWITCH; J. Lukaszewski, Chicago, Ill. App. filed April 30, 1925. Lever type; characterized by the removability of a certain portion or portions of the switch from the main portion, whereby several relatively movable electric instrumentalities may be distantly separated without necessitating the disconnection of the lead wires extending from said instrumentalities or current supply from the elements of the switch to which they are connected when the switch is assembled for operation.